THE IRON AGE

New York, October 28, 1915

ESTABLISHED 1855 VOL. 96 : No. 18

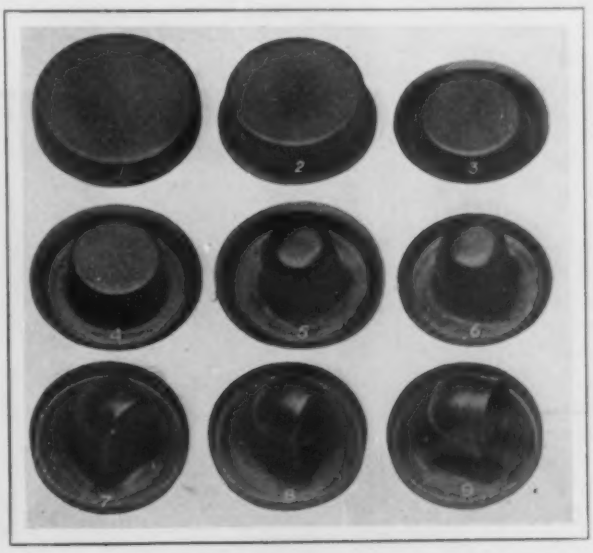
Stamping an Automobile Muffler Head

Successive Operations in the Making of a Sheet Metal Substitute for a Part Formerly Made of Cast Iron

BY F. L. PRENTISS

The general tendency in the building of automobiles is to reduce the weight wherever possible without impairing the strength, and this has led some makers to substitute sheet metal stampings for cast iron for various parts. In addition to reducing the weight there are other advantages claimed for these parts such as the elimination of machine work and the shipment and handling of parts without breakage. This substitution of sheet-metal stampings has necessitated some difficult and very interesting drawing operations. One very difficult stamping is a muffler head for the Chalmers automobile, the manufacture of which was recently undertaken by the Acklin Stamping Company, Toledo, Ohio.

This stamping requires ten operations which are shown in the accompanying illustration. The first operation is done on a simple combination die that cuts the blank and draws it down as shown in the upper left corner at 1. The die used for this operation is of the standard type operating on spring rubbers in the bed of the press. The first reduction, which is also done on a die of a standard type, operating on spring rubbers in the bed of the press, is shown at 2. This operation is merely to reduce the diameter of the shell from the first operation and at the same time to leave a small flange on the outside.



Successive Stages in the Stamping of an Automobile Muffler Head from Sheet Metal

At 3 is shown the cup turned inside out. The die used for this operation is also of the standard type. In this operation the flange which appears along the outside of the piece is roughly provided for, and at the same time the body is reduced in preparation for the center part of the muffler. Still further reductions are illustrated at 4 and 5, the operations being similar to the third one.

The shell from the outer flange is shown at 6. The preceding operations have made the outline of the flange somewhat uneven and it is necessary to trim the flange so as to get it true on the top when it is finished. The trimming is done in a standard die which is provided with a pad in the lower die to locate and eject the work. At 7 the piece is seen finished apparently to size and shape. The outer flange in this operation is edged and struck to proper taper, the main body is struck and sized all over and the portion connecting the body to the flange is formed to the proper taper and smoothed out. Operation No. 8 is the punching of holes on the outer flange through which to rivet the body and the head of the muffler together.

The ninth operation which is also shown in the same view as the previous one is the punching of the hole in the side of the center body. This hole is punched in the die which goes on a horn press. The die itself is reversed from the ordinary position, the punch being placed below and the die above. This method is adopted for the reason that it would be impossible in the limited space to provide a passage through the horn for the slug which comes out of the hole, and also for the reason that it is easier to gage the stamping with the die arranged in this manner than in the regular way.

In the lower right corner the muffler head in its finished shape is illustrated. The finishing operation of drawing the flange is the most difficult one, it being made so by the fact that it is impossible to get a die of any regular construction to do the work. The peculiar difficulty is that it is necessary to have the punch on the inside of the piece and to force the shell down around the punch. It is impossible to obtain more than about 40 per cent bearing surface for the upper die on the shell and this is not sufficient to do the flanging work, unless the stamping is firmly fastened so as to prevent it from skidding when the operation is performed. As the flange is turned up on an angle with the central axis and as

the stamping itself must slide along the axis of the hole a complicated arrangement of sliding gages and supports is necessitated. The horn that is used in this operation is identical in design with the one used in the previous operation, the horn fitting in the same press, the variation being only in the gaging and in the upper die.

The muffler head is made from hot rolled pickled strip steel 0.078 in. in thickness. The shell is annealed only once, between operations 6 and 7. The principal breakage comes in operation 7 which is the finishing of the shell to shape, this being caused by the fact that the metal used varies somewhat both in thickness and in drawing qualities, so that the amount of metal that is gathered in this operation also varies in cubic volume even though the surface is the same. When an attempt is made to draw the stamping to a perfect shape it is found that some of the pieces do not have sufficient stock and therefore crack, and some have too much stock and for that reason wrinkle. However, the loss due to breakage resulting from the varying thickness of metal is said to be quite small.

Wide Face Ring Wheel Grinding Machine

An improved flat surface grinding machine has been placed on the market by Charles H. Besly & Co., Chicago, Ill. In general construction, the machine is the same as the builders' single-spindle lever feed disk grinding machine except that one end of the spindle is equipped with a pressed steel chuck holding a wide face vitrified ring wheel for roughing off scale and excess stock. In this way it is possible for the work to float on the face of the wheel which has a grinding surface from 8 to 10 in. wide. The opposite end of the spindle is equipped with the ordinary steel disk wheel set up with cloth back abrasive disks for finish grinding.

The body of the chuck is of pressed steel and is double riveted to a cast-iron center into which the spindle bearing projects. The chuck body is drilled and tapped from the back to receive headless threaded plugs for balancing, and the grinding wheel is held in the chuck by pressure on its periphery applied by a wrought steel tapered clamp ring. This ring is drawn into the tapered chuck body by screws operated from the back of the chuck body. The center hole of the grinding wheel is filled with a steel plate, which is relied upon to guard the heads of the screws holding the chuck on the spindle, thus doing away with external projections. As the grinding wheel wears away a laminated wood plate which is supplied with the chuck may be employed to set out the wheel.

This machine is designed to handle flat surfacing work that is now being done on milling and planing machines and the accompanying illustration shows the grinding of automobile gear shifter covers. These are of malleable iron, are rather frail and are ground without rigid chucking. In this way, it is pointed out, the danger of distortion that is present where castings of this nature must be clamped for milling is eliminated. The workholder is simple, the work resting loosely on three studs projecting from the face of the angle plate and being located and supported on this three-point bearing by four studs projecting from the plate. This work is handled at the rate of 200 grinding operations per hour per operator or 100 castings roughed and finished per operator. As the machine accommodates two operators the production is 200 finished castings per hour.

Another class of work handled by this machine is the grinding of pillow blocks and caps. The bottom of these blocks, which are of cast iron, measures 6 x 13 in. and was formerly surfaced on an adjustable-speed, motor-driven shaping machine, using high speed tools. With a view to making this piece suitable for grinding instead of shaping, the pattern was changed, very little stock being left for finishing while the surface was recessed in molding to facilitate grinding. The maximum amount of stock which the grinding wheel has to remove to finish the piece is only 1/16 in. The time formerly required for handling the work on the shaping machine was approximately 20 min., while on the grinding machine these surfaces are roughed and finished to the proper size and shape in less than 2 min., including a test on the surface plate.

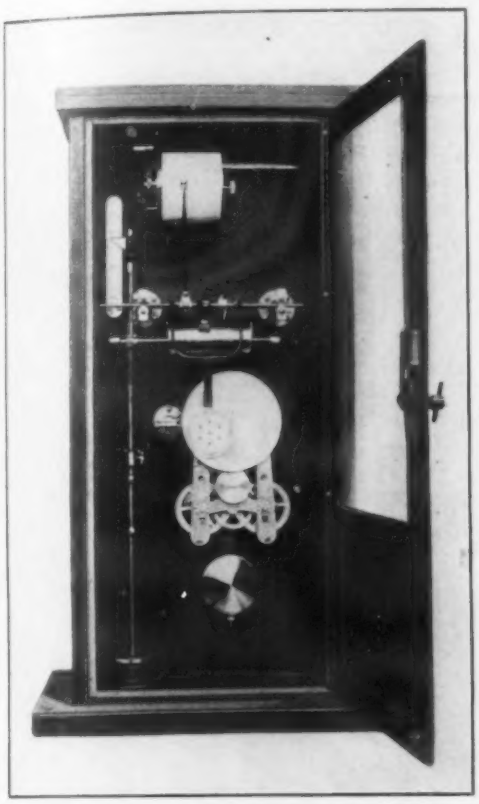
This machine is built in two sizes, one mounting a wheel 24 in. in diameter with an 8-in. hole, while the other has a grinding wheel 30 in. in diameter with a 10-in. hole. The wheels are 3 in. thick when new and can be worn down to 1 in.

Performing 200 Rough and Finished Grinding Operations per Hour on Automobile Gear Shifter Covers on a Wide Face Ring Wheel Grinding Machine

The Cleveland Blow Pipe & Mfg. Company, Cleveland, Ohio, manufacturer of dust collecting and ventilating systems, etc., has removed from West Third Street to larger quarters at 6302 Kinsmore Road. The new plant provides the company with double its former amount of floor space.

Improved Lea V-Notch Meter Integrator

A new and more heavily designed integrator for use on the Lea V-notch recording liquid meter has been brought out by the Yarnall-Waring Company, Philadelphia, Pa. Among the changes that have been made



An Improved Form of Integrator for V-Notch Meters Having Separate Clock Mechanisms to Operate the Integrator and the Chart Recording Device

in the integrator are the use of separate clock mechanisms for operating the integrator and the chart recording device and the elimination of thumb screws for making adjustments.

In the new type of integrator the counter is driven by an aluminum dial that itself is driven by a pendulum clock movement having a double heavy spring. This clock mechanism is entirely separate from that operating the chart recording mechanism, it being pointed out that if either clock should become deranged in service the record of the other clock is available, thus preventing interruptions of readings, and it is also possible to check the clocks one against the other.

It was found in service that vibration would sometimes cause the thumb screws used for making adjustments in the original instrument to loosen slightly. To overcome this heavy screws with slotted heads have been provided in the new instrument for making the adjustments.

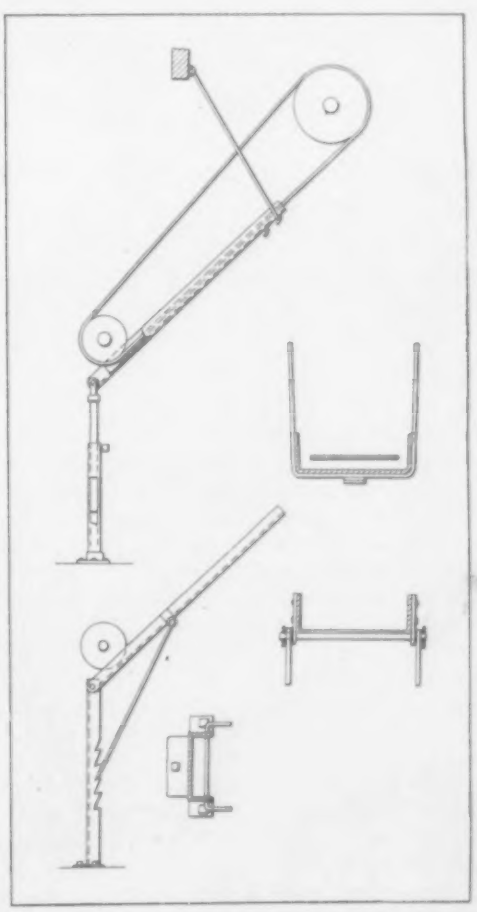
Other changes include the simplification of the adjustment for the pen arm and the yoke supporting the counter dial on the integrator and the securing of an air-tight joint between the case and the door. In this way, it is pointed out, steam, vapor or dust cannot enter the case, as the door is equipped with a tongue entering a felt-lined groove. The locking device, which is of the three-way type, jams the door against the felt, thus making practically an air-tight joint.

Plans are said to be under way for the resumption of work on the plant of the Southern Aluminum Company in North Carolina. It was about three-fourths completed on the outbreak of the war, when operations were suspended owing to inability to raise the necessary capital. French interests have been in control of the property, but American capital, it is said, will probably be found for the completion of the plant.

Adjustable Sheet Metal Guard for Belts

C. C. Paeschke in February, 1914, applied for a patent on a belt guard that is in use throughout the plant of the Geuder, Paeschke & Frey Company, Milwaukee, Wis. The claims have been allowed, but instead of manufacturing and selling the device, Mr. Paeschke has decided to grant the privilege of making these guards free of charge to any manufacturer who desires to put them in service in his own plant. The special feature of the guard is that provision has been made for readily removing and replacing the belts as well as the adjustment that is provided for adapting the guard to different machines, the driving pulleys of which are located at varying distances from the floor.

The guard consists of a trough-shaped fender made of some material such as sheet metal and is pivoted or hinged at one end to a support adjacent to the pulley of the machine, the driving belt of which is to be protected. The fender is substantially straight and the support is constructed in different ways according to varying conditions consisting of either a post or stand fastened to the floor adjacent to the machine or some device for suspending it from the ceiling. The stand is designed so that it can be lengthened or shortened to raise or lower the end of the fender and where this arrangment is employed the stand consists of telescoping pipe sections held in place by a set screw, the fender being fastened to a fork or cross



A Guard for Belts Made from Sheet Metal That Is Capable of Adjustment for Varying Heights of Pulleys

arm attached to the upper end of the inner adjustable section while the outer section has a flanged socket piece which is bolted or fastened to the floor.

The fender is made of such a length as to extend upward from the support to which it is

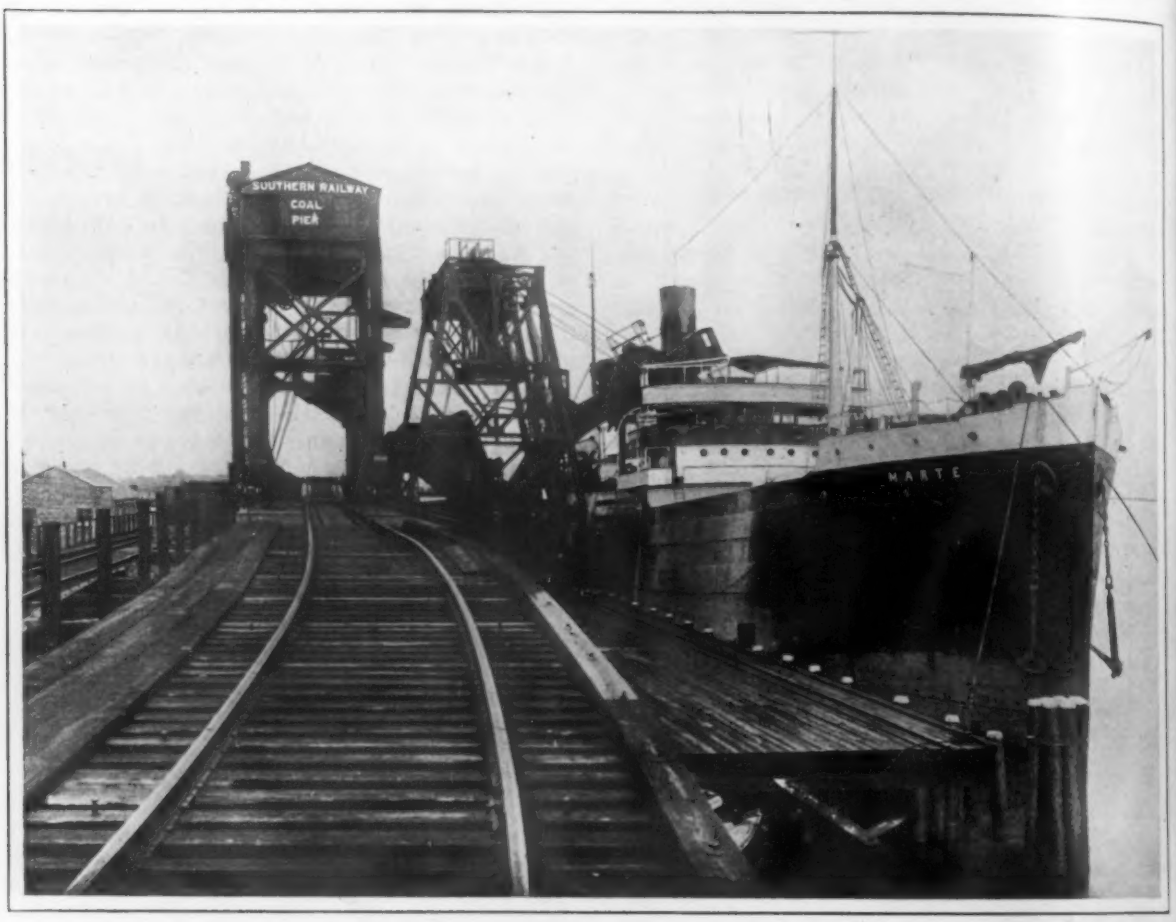
fastened to a point somewhat higher than the head of a man of average stature and is normally held in place parallel to the lower side of the belt by a releasable supporting mechanism. This consists of a U-shaped rod suspended by screw eyes or eyebolts from an overhead timber and fastened to the upper end of the fender. This arrangement enables the fender to be swung backward and downward for removing or replacing the belt when necessary. To adapt the guard to varying conditions and to sustain it in working position at different angles corresponding with the varying inclination of the belts to which it may be applied, the fender has a series of hooks or catches on the under side for engagement with the cross piece of the U-shaped rod or bail.

Another arrangement for supporting the fender entirely by the post or stand to which it is hinged or pivoted is shown in the lower portion of the accompanying drawing. In this form of guard the post or stand to which the fender is hinged or pivoted, consists of a metal channel bar with the web and flanges turned at the lower end to form a base. The upper portions of the flanges of the channel are formed with a series of notches into which the cross piece of the U-shaped brace or supporting rod drops. For replacing the belt the brace is disengaged from the notches in the post or stand and the fender swung back on the hinge. The sides of the fender in either form of guard cover the edges of the lower side of the belt, thus preventing a person from coming in contact with it and being injured.

Liveright Brothers, Philadelphia, announce, under date of Oct. 23, that they have withdrawn all prices on their Gold Medal brand files.

Mechanical Loading Coal Handling Plant

A new type of coal handling plant that is attracting considerable attention has recently been built for the Southern Railway at Charleston, S. C., by the Wellman-Seaver-Morgan Company, Cleveland, Ohio. This plant differs from other coal handling plants along the Atlantic seaboard in that the coal is mechanically loaded on the boat instead of being elevated and allowed to flow by gravity into the boat. In fact it is said to be the first plant to be erected anywhere of any size arranged for mechanical loading. Another coaling plant designed for loading boats mechanically will be erected by the Baltimore & Ohio Railroad Company at Baltimore, but the handling equipment in this will be radically different from the Charleston plant. Another important advantage claimed for the mechanical handling plant is that one can be erected at a much lower cost than the high gravity pier plant. The mechanical handling type of plant is claimed for this reason to be a very satisfactory one for a railroad that does not want a large plant and does not feel warranted in going to the expense of building one of the gravity type. There is also said to be a very limited breakage of fuel when handled mechanically. The Charleston plant since it was placed in operation a few weeks ago is said to have exceeded expectations in its handling capacity and in the little breakage of coal.



A Recently Completed Coal Handling Plant Consisting of a Car Dumper at the Left, a Receiving Hopper at the Bottom of the Central Tower and the Mechanical Loading Arm at the Right

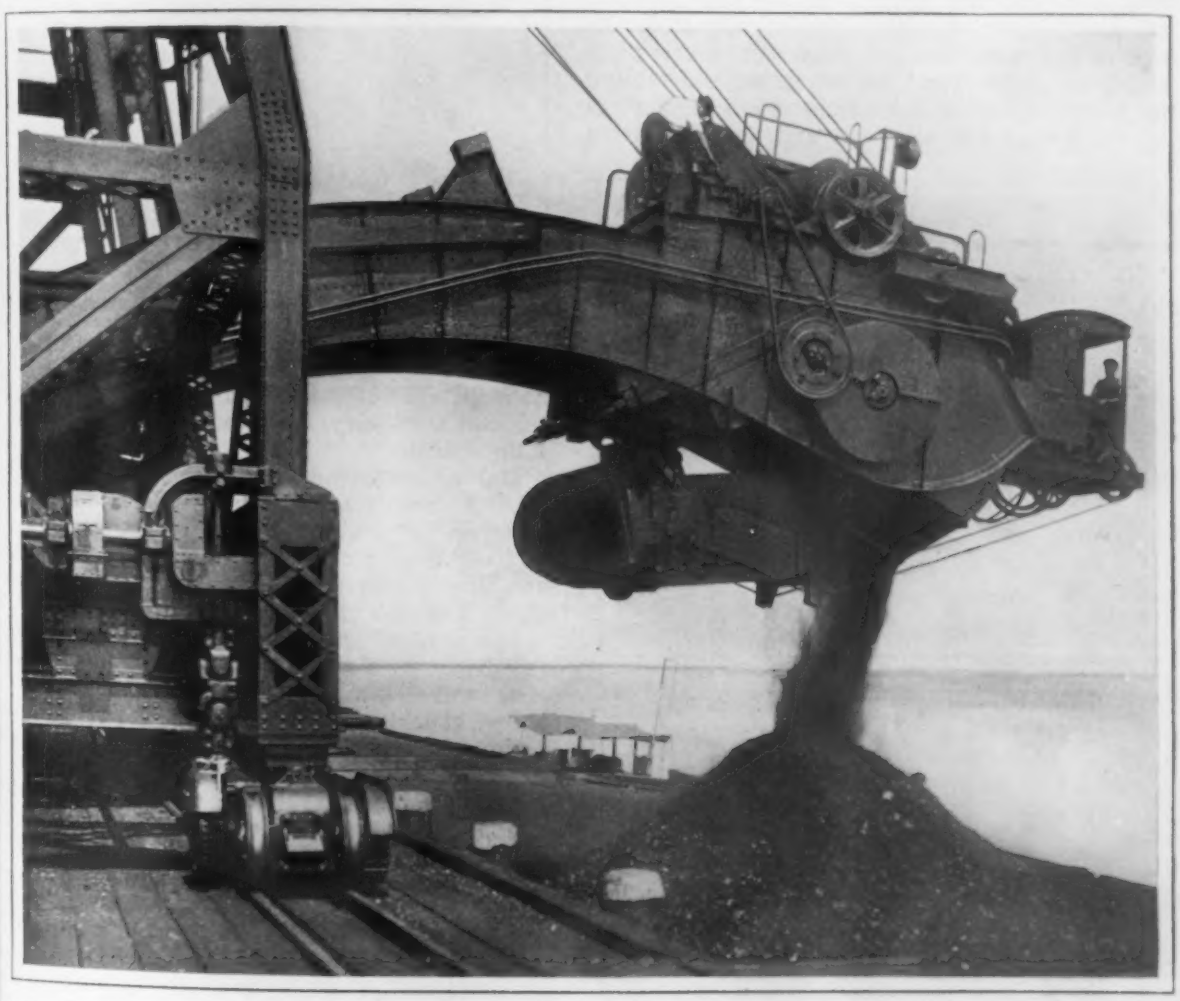
The plant consists of a wooden railroad trestle built out into the bay about a half mile to reach deep water and a pier at the end of the trestle about the length of a boat. The loading machinery is located on this pier, where there is a steel trestle that carries the cars up 17 ft. above the pier, and on the top of the trestle is located a movable car

dumper of standard type. Adjoining the trestle and car dumper is a movable loading tower that moves on the top of the pier at the same elevation as the foot of the trestle. The reason for providing a trestle is to have a car dumper of sufficient height to dump the loaded coal cars into the hopper that is a part of the loading tower equipment.

The incoming cars are dumped in the usual manner into this V-shaped steel hopper, which is of 100 tons capacity. The hopper has a movable false bottom to prevent coal from dropping a great distance and consequent breakage. The hopper discharges the coal upon a conveyor which carries it through a long curved arm that extends out over the boats and barges to be loaded and dumps it into a telescopic chute at the end of the arm. The arm, together with its chute and trimmer attached to its outer end, is arranged for a hinged vertical motion for height and also has an 8-ft. horizontal movement so that it can be adjusted for boats of different widths. When a boat is placed on the dock for loading the curved arm or boom is lowered over the hatch and the telescope is extended nearly to the bottom of the boat. One of the accompanying illustrations shows the position of the arm when the barge is being loaded. In loading barges trimming is not required and it is not necessary to use the chute, so that in this photograph the telescopic chute is drawn in and folded up against the arm. The conveyor is kept in continual operation and when the chute is used it is shortened from time to time as the boat takes its cargo. The trimmer is of the Blake type which rotates in a circle and trims off the sides, there being a small motor on the side of the chute for operating the trimmer.

The conveyor is of the scraper type, 8 ft. wide, built of angles and plate sections spaced 4 ft. apart. The conveyor has a speed of 150 ft. per minute and carries the coal about 40 ft. It has a capacity of 3600 tons per hour, which is more than sufficient to handle all the fuel at the speed that it can be delivered by the dumper. The entire plant is designed to handle thirty cars per hour in capacities up to 100 tons each.

The entire plant is electrically operated, alternating current furnished by a local power company being converted to low-voltage direct current in a substation on the pier. The motor equipment includes two 225-hp. motors for car dumping, one 100-hp. motor for moving the dumper up and down the pier, one 100-hp. motor for moving the tower, one 100-hp. motor for operating the hopper, one 100-hp. motor for operating the scraper conveyor, one 35-hp. motor for raising and lowering the arm and moving it back and forth, two 15-hp. motors for raising and lowering the telescopic chute, one 3½-hp. motor for operating the trimmer, and one 3½-hp. motor for operating the cut-off gate that regulates the flow from the hopper. It requires three men to operate the plant. One stands in the cab at the end of the arm and loads the boat having control of the hopper and the other motors connected with the loading mechanism. One man operates the car dumper and the third regulates the moving of the tower along the dock.



A Portion of the Tower and the Loading Arm During the Loading of a Barge with the Telescopic Chute Drawn In and Folded Up Against the Lower Side of the Arm

---

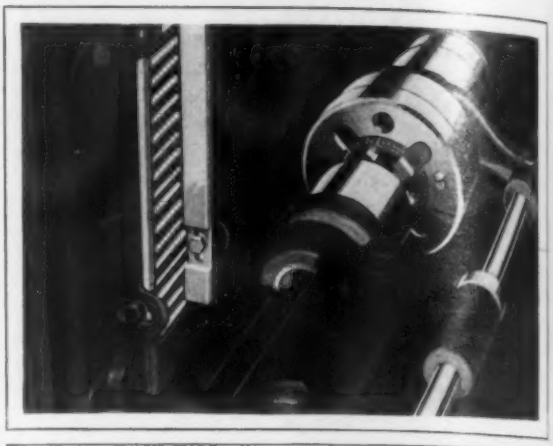
A 70-ton refrigerating plant for oil cooling for the Ford Motor Company, Detroit, was included among recent sales of the Triumph Ice Machine Company, Cincinnati, Ohio.

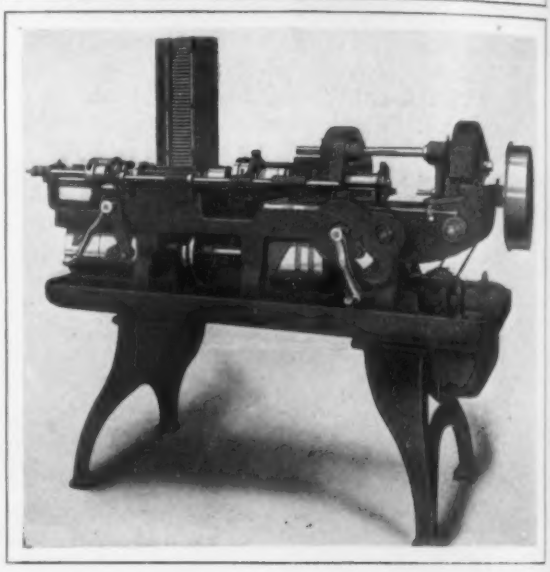
NEW THREADING MACHINES

A Group of Four for Secondary Operations on Screw-Machine Products

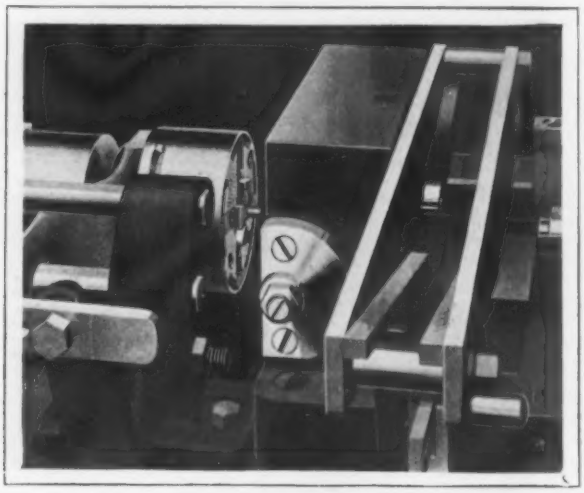
In the manufacture of screw machine products there are various secondary operations that must be performed after the parts leave the screw machines. A number of machines designed for automatic or semi-automatic operations in the completion of small screw machine parts with a view to securing accuracy, maximum production and minimum labor costs, have been brought out by the National-Acme Mfg. Company, Cleveland, Ohio.

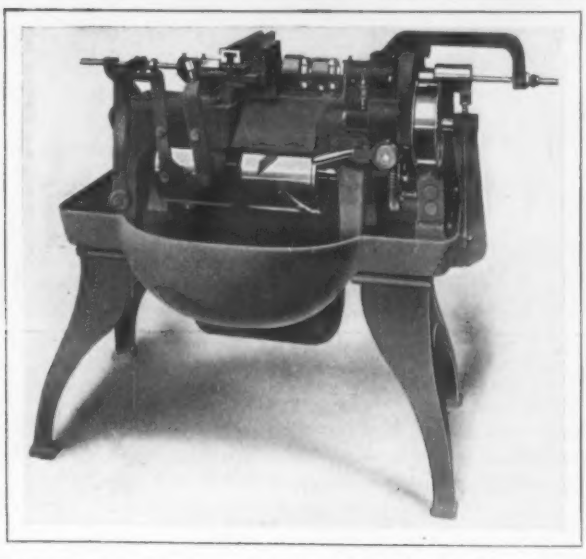
One of these is a stud threading machine known as the No. 1, which is a high-speed automatic machine designed particularly for the rapid threading of milled studs. An interesting feature of the machine is the method of feeding and extracting the work. Ordinarily, in stud threading work the piece is fed into the machine and is extracted when the die recedes by being pushed out by the piece that follows. In this machine the pieces are dropped into a horizontal magazine from which they are fed through a receiving tube by a push rod. When the die is opened, the jaws holding the threaded piece recede, allowing the piece to drop out instead of requiring it to be extracted. As soon as the threaded piece drops out, a new piece is fed up to the stop. As extracting and feeding are practically simultaneous operations, no time is lost in forcing the piece out and then oscillating the stop. The stop is supported in the die spindle and held stationary, being adjusted from the rear of the spindle.





Machine for Threading 1-In. Studs Equipped with a Vertical Magazine from Which the Pieces to be Machined Are Taken One at a Time and Passed into the Receiving Tube



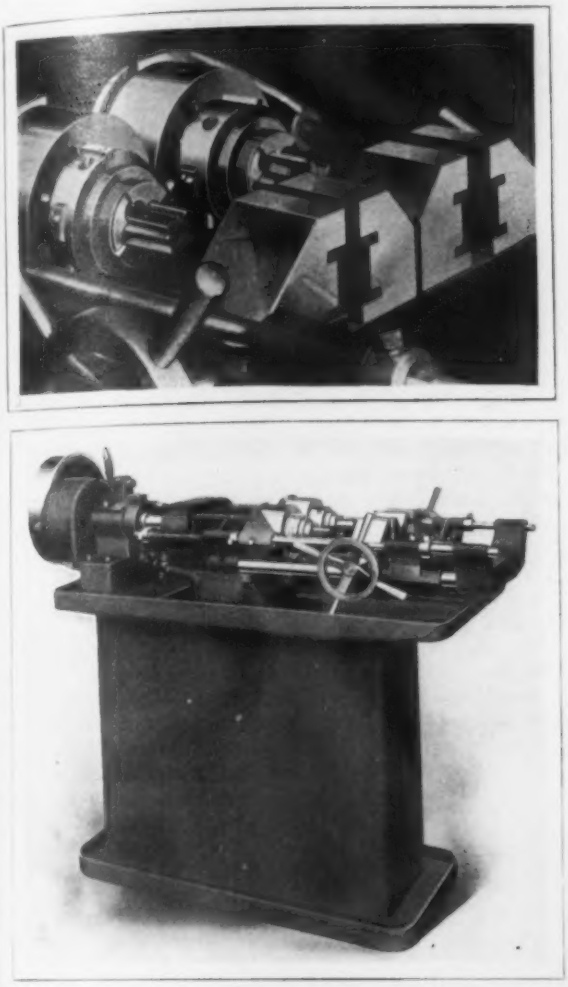


Stud Threading Machine for Sizes up to ½ In. in Diameter in Which the Pieces Are Fed from a Horizontal Magazine through a Receiving Tube by a Push Rod and the Finished Stud Drops Out of the Die, with a View of the Feeding Mechanism Above

During the threading operation the tool revolves and the work is held stationary. The tool is not forced on but follows the lead of the thread until the die comes in contact with the stop set for the threading length, when it is automatically tripped open and backed off without reversing.

The machine is comparatively simple in design. It is driven by a single belt, the production speeds being controlled by a system of change gears. The feeding, chucking and extracting of the work as well as the operation of the die head for threading are controlled by cam drums. Safety frictions are provided, control being through a single hand lever, and there is constant forced lubrication through the tool. The production rates of the stud and bolt threading machines are said to be about normal for the spindle speeds available, but will vary somewhat, depending on the kind of material and the other working conditions. The machine has a capacity of threading studs ¼ to ½ in. in diameter inclusive. It is 48 in. high, 30 in. wide, 64 in. long and weighs approximately 750 lb.

The other stud threading machine, which is known as the No. 2, is intended for a larger class of work. This machine, which resembles the builder's automatic multiple-spindle screw machine, is designed for threading studs from blanks or those which have been threaded on one end on the screw machine and for threading other products of the same general size and shape. Its capacity is for threading studs ½ to 1 in. in diameter



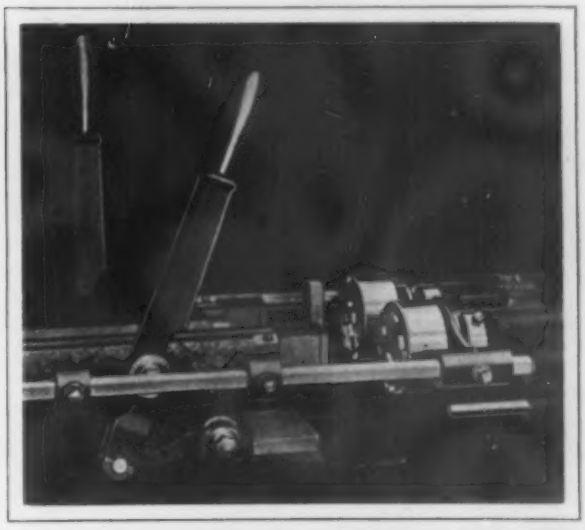
Threading and Tapping Machine for Bolt and Screw Blanks, Spring Clips and Bars Equipped with Double-Grip Vises Having Special Inserted Jaws to Accommodate the Different Sizes and Shapes of Work

inclusive. This machine has an upright magazine, the stud blanks being passed from the bottom of the magazine, one at a time, into the receiving tube back of the chuck by a cam-controlled movement of the feed-in slide. From this tube each blank is chucked in turn by a push rod working from the rear. In feeding the new blank the finished piece is automatically extracted as the die recedes. As the spindle chucks holding the work do not revolve there is no tendency to clog and wind the blank in the spindle tube. Adjustment for the different sizes is made by expanding the guide walls of the magazine for the length of the piece and substituting a chuck of the required capacity. The spindle tube is changed for extreme sizes only. Power is supplied by a single belt and change gear system to cams mounted on drums, one cam controlling the feeding operation and the other the movement of the slide carrying the die. This machine is 55 in. in height, 78 in. in length, 21 in. in width and weighs 1500 lb.

The new two-spindle bolt threading machine is known as the No. 2 bolt threading machine and is designed for threading screw blanks, either milled, struck up or forged, with regular or irregular shaped heads and also for threading bars of any length. The threading mechanism consists of two spindles for carrying the thread cutting dies, the spindles being driven through change gears by a single belt. Opposite and in line with the threading spindles are two slides upon which blocks carry the work toward and away from the tools. The machine runs either right or left handed. Forced lubrication is provided. In operation the blanks are pushed into the holders by hand and held rigid for threading without locking, thus saving operating time. The slide is then fed forward by the hand lever until the die begins to cut, when the lever is released and the work advances by the lead of the thread itself. By using the builder's self-opening die it is not necessary to reverse the spindles. When the proper length of thread has been cut, an adjustable stop engages a fork fitted into the spool of the die and trips it automatically. The backward movement of the slide for extracting and reloading closes the die.

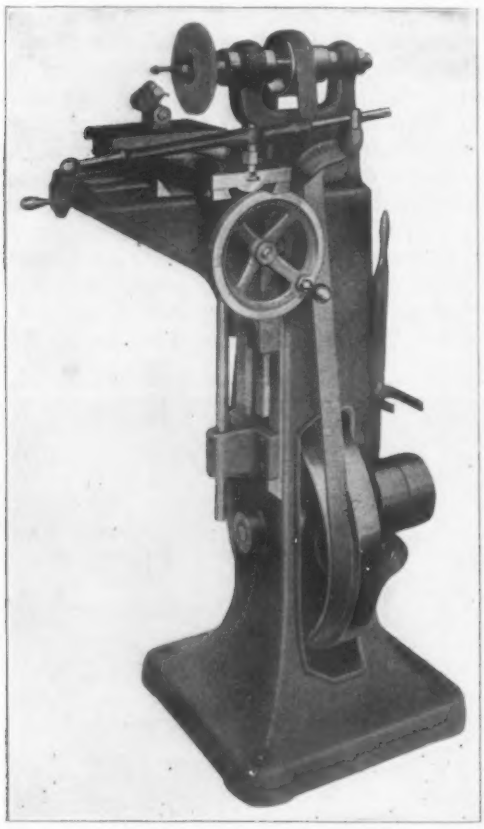
Holders with interchangeable grips for standard sizes of hexagon and square head screw blanks are furnished. For bar threading ways are cut into the slide blocks used and a stop operating from the rear holds the bars in place. The capacity of the machine is V and U. S. threads 3/16 to $\frac{5}{8}$ in. in diameter and S. A. E. threads 1 in. in diameter. It is 39 in. high, 50 in. long, 20 in. wide and weighs approximately 770 lb.

The No. 2-A bolt threading and tapping machine for threading bolt and screw blanks, spring clips and bars and for tapping with collapsible taps completes this group of machines. In general the design of this machine is similar to the one just described with the exception of the work holders. In place of blocks mounted on the tool slides to carry standard special work holders there are two double-grip vises in which special jaws are inserted to accommodate special sizes and shapes of work. The work is placed in the holding jaws



A Two-Spindle Machine for Threading Screw Blanks of All Kinds and Bars and the Operating Levers Controlling the Movement of the Slide Preparatory to Cutting the Thread

by hand and locked in alignment with the tap by a turn of the handwheel. The slide is then advanced by hand until the work engages the tool, after which it follows the lead of the thread, insuring acurate pitch on the work. Tapping continues until the gage lever comes in contact with the adjustable stop, when the trip is operated, automatically freeing the work. The backward movement of the slide sets the tool for the next piece. Feeding and extracting are alternate operations so that the production rate is largely dependent upon the operator's skill and upon the class of work. The capacity of this machine is cutting V. and U. S. threads 3/16 to 5/8 in. in diameter inclusive and S. A. E. threads up to 1 in. in diameter, and for tapping V. and U. S. threads 15/32 to 5/8 in. in diameter inclusive and S. A. E. threads up to 1¼



Machine for Grinding the Faces and Throats of Die Chasers as Well as Tools of Various Kinds

in. in diameter. The dimensions of this machine are the same as No. 2. It weighs approximately 875 lb.

A new tool grinding machine has been brought out which is designed primarily for grinding the faces and throats of die chasers. It is also adapted for grinding circular forming tools, blade tools, reamers and for miscellaneous tool grinding. An important feature of this machine is the work bed which consists of three slides, providing a wide range of adjustment in three directions and at the same time a rigid support for the work while it is being ground. The machine is provided with a loose pulley so that the grinder can be belted to either the main shaft or to a countershaft. The drive is through a two-step pulley at the top and bottom of the upright column. This provides variable grinding speeds and compensates for the wear on the grinding wheel when necessary. The top shaft bearings are hardened, ground and run in phosphor bronze bushings that are adjustable for wear. Special fixtures for holding the work are mounted on the work bed by key-bolts. The equipment includes standard fixtures which make the machine adaptable for a wide range of grinding. Fixtures can be made for such grinding as the holders that are furnished do not cover. The illustration shows the machine equipped with fixtures for grinding throats of dies. Fixtures for grinding faces of chasers four at a time and centers for taps and reamers and circular and blade forming and shaving tools are also furnished. The machine is 46½ in. high, 18 in. long, 21 in. wide and weighs approximately 330 lb.

Cleveland-Cliffs Mining School

The mining school of the Cleveland-Cliffs Iron Company is of that class of trade schools known as industrail corporation schools, the purpose of which is the mental improvement of those already enlisted in the industry. Some particulars regarding the school were contributed to the recent meeting of the Lake Superior Mining Institute by C. S. Stevenson, Ishpeming, Mich., director of the educational department of the company. From these the following notes have been taken:

The prime function of the school is to train to the highest possible degree of efficiency the English speaking men upon whom this inexperienced foreign product depends for its guidance. The school, therefore, is not open to all underground employees of the company, but concerns itself only with a group of men who are carefully selected by the superintendents and mining captains on a basis of their ability and mining aptitude.

In the beginning it was noted that the men were as a rule indifferent, if not antagonistic. Gradually, but not without difficulty, prejudices were broken down partly by the statement that in so far as possible all men chosen for shift bosses will be taken from the ranks of the mining school. On June 1, 1915, the work of the first class, comprising thirty-three men, was completed.

The work of a single class is designed to cover 1½ years. Each miner attends two classes a week, each of an hour and a half. If the miner is working on the day shift he attends the evening classes and if he is working on the night shift he attends the afternoon sessions. All of the class work is done on the miners' own time and they receive no remuneration from the company for that given to the school work.

The mining school began its first class with an enrollment of thirty-eight men, and of these thirty-three successfully completed the work. Four of the five men, who did not complete the course, withdrew on account of business conditions, which made their attendance impossible. The men are not children but of mature years and respected in the communities in which they live, and great care is taken not to wound their pride and self-respect. The formal atmosphere of the ordinary class room is avoided.

The subjects taught are: Arithmetic, elementary drawing, geometrical drawing, mechanical drawing, geology, construction and use of mine maps, first-aid to the injured, time-keeping, mine sampling, mining methods, and business correspondence.

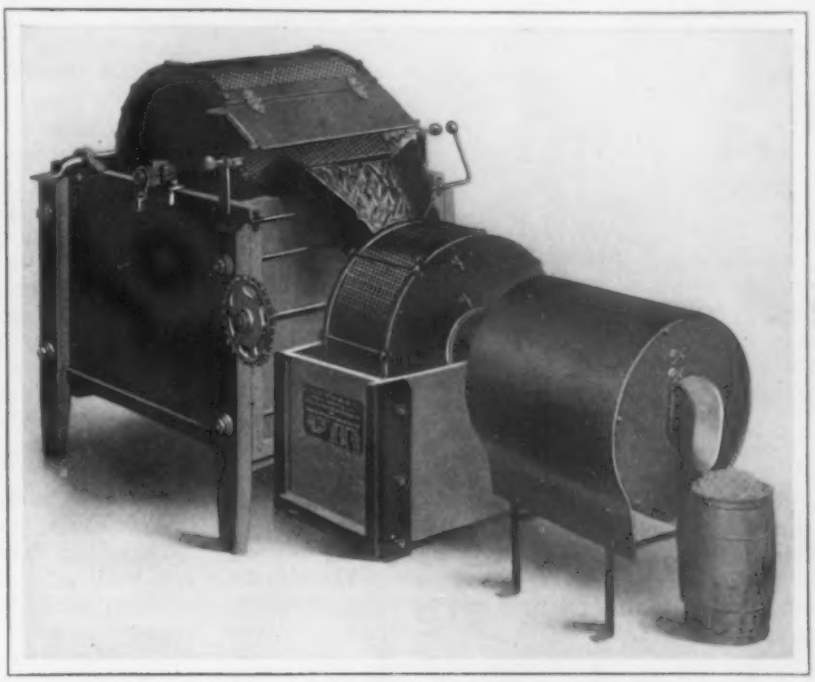
Rendering fine ores suitable for blast-furnace practice is the subject of a novel patent (U. S. 1,098,883) granted to Bernard T. Colley of Rancagua, Chile. He converts the sulphur dioxide from the roasting ores into sulphuric acid, 20 per cent or stronger. This acid is then thoroughly mixed with crushed limestone and agitated, forming calcium sulphate, which is then mixed with the roasted ore to the extent of 5 per cent, where it exercises the same briquetting power as plaster of paris.

The Gulf States Steel Company, Birmingham, Ala., has awarded contracts for about $57,000 worth of improvements to its finishing mills, including the installation of additional heating furnaces at the rod mill, involving two gas producers and a hydraulic pusher, as well as an extension to the galvanizing department, 40 x 300 ft., with the addition of annealing galvanizing pans with motor, reeling frame, etc.

A New Form of Electroplating Barrel

An apparatus which renders the process of electroplating entirely automatic has been developed by the U. S. Electro-Galvanizing Company, Park Avenue, Brooklyn, N. Y. It consists of an automatic plating barrel for treating material such as nails, screws, rivets, washers, stampings, etc., in bulk, and when used in connection with automatic cleaning and drying apparatus plates, washes, dries and discharges the material without handling from the time it is placed in the barrel until it is delivered. The entire equipment includes the plating barrel suspended on the top of the tank and a machine in which the material is washed after being plated, drained and dried.

The plating barrel is constructed of a special material similar to black rubber in appearance but that has practically the same tensile strength as metal and is non-absorbing. This barrel is suspended on top of the tank instead of in the solution and as a result no moving parts are immersed in the solution. The construction of the plating barrel is such that the material is emptied when the plating is completed by simply shifting the belt to the loose pulley and reversing the motion of the barrel, the material being then automatically emptied into a receptacle or into the washing and drying machine. The placing of the barrel on top of the tank, it is emphasized, is advantageous as a larger anode surface is secured and the material is spread out over a greater surface, thus giving a more even distribution of the plating and a quicker coating.



A Combination of Plating Barrel and Self-Emptying Washing Apparatus Delivering Work Ready for Polishing or Shipment

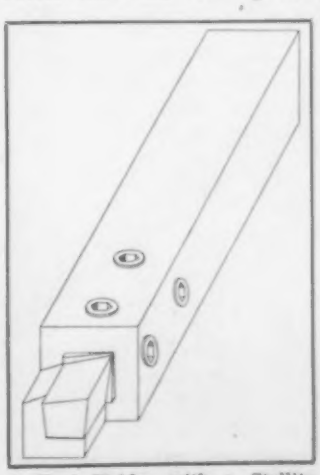
In operation the material to be plated is shoveled in the plating barrel by a laborer and the starting lever moved. This action automatically closes the door of the barrel and the plating process begins. A receptacle is placed at the end of the machine where the finished product is to be ejected and it is possible for one operator to attend to three or four plating barrels as the time required is from 30 to 60 min., depending on the thickness of the coat required. When the process is completed the operator throws the belt on the loose pulley and two or three turns of the barrel in the opposite direction automatically empties the material into the washing and drying drum. This device is in direct connection with the plating barrel and after the material is emptied into the washing drum the plating barrel is filled and again started for plating, thus starting the washing and drying device also.

While the second batch is being plated, the first one is automatically washed, drained and dried and if tumbling or polishing is required the dried articles can be automatically delivered into a polishing drum, from which they are removed, completely finished. The washing and drying apparatus consists of three drums for washing, draining and drying. The batch of material received from the plating barrel is washed and delivered a few pounds at a time into the draining drum, from whence it is carried into the drying apparatus in small lots. This consists of a drum with a separate inner cylinder, the latter half of which is perforated. This device is installed at a slight angle so that the emptying end is a trifle lower than the loading one.

As the material enters the drying drum it mixes with sawdust, which is carried forward with the material by the rotation of the drum and also by gravity until it reaches the second section of the inner cylinder where the sawdust is sifted into the the outer shell. A gas burner underneath the drying drum keeps it hot and dries the sawdust, which, after being dried, is carried by pick-up pockets to the entering end of the drum, where it mixes with the new material coming in to be dried. The plated material continues to travel through the drying cylinder and is ejected into a keg or receptacle, which is placed there for the purpose of receiving it. When the plating of the second batch is completed all of the first lot of articles has been discharged from the drying drum.

Lathe Tool Holder with Stellite Cutter

The Ready Tool Company, Bridgeport, Conn., has brought out a tool holder with an inserted Stellite cutter that has been specially designed for use in a boring mill or vertical turret lathe. Aside from holding the cutter rigidly, the tool is designed so that by turning it a right or left-hand tool is secured.

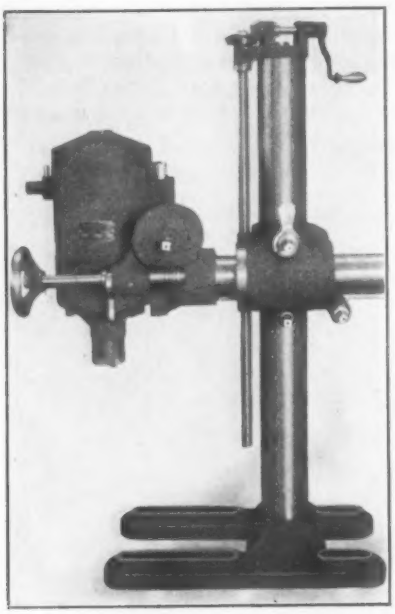


A Tool Holder with a Stellite Cutter Intended for Use in a Boring Mill or Vertical Turret Lathe

The holder is intended to take a 6-in. length of square Stellite and support it on the bottom and the back, the cutter being held in place with hollow set screws which are relied upon to provide the rigidity required for tools of this kind. By moving the holder through an arc of 90 deg. it is possible to secure either a right or left-hand tool with clearance and side slope either way.

Portable Scotch Radial Drilling Machine

The Cincinnati Electrical Tool Company, Cincinnati, Ohio, has brought out a portable electric Scotch radial drilling machine which is equipped with either alternating or direct current motors. The drill spindle is mounted on the end of the motor armature, and vertical, horizontal and angular adjustments are provided. The motor, drill and knuckle have a vertical adjustment on the upright column through beveled gears engaging with a feed screw which is 34 in. long, while the horizontal adjustment is provided by a rack on the cross-arm and a pinion in the supporting knuckle. By this adjustment the motor can be set at any distance from the column up to 24 in. The revolving bearing in the knuckle supporting the cross-arm has a graduated collar, so that the drill may be set at any angle by manipulating a worm and wormwheel in the knuckle, this arrangement being relied upon to prevent the motor from turning or dropping while adjustments are being made. The drill has a feed of 10 in. through a handwheel with quick return, and the handwheel and the worm box are adjustable for drilling in either a horizontal or vertical position, thus enabling the operator to get into close corners.



A Portable Scotch Radial Drilling Machine with Electric Motor Drive

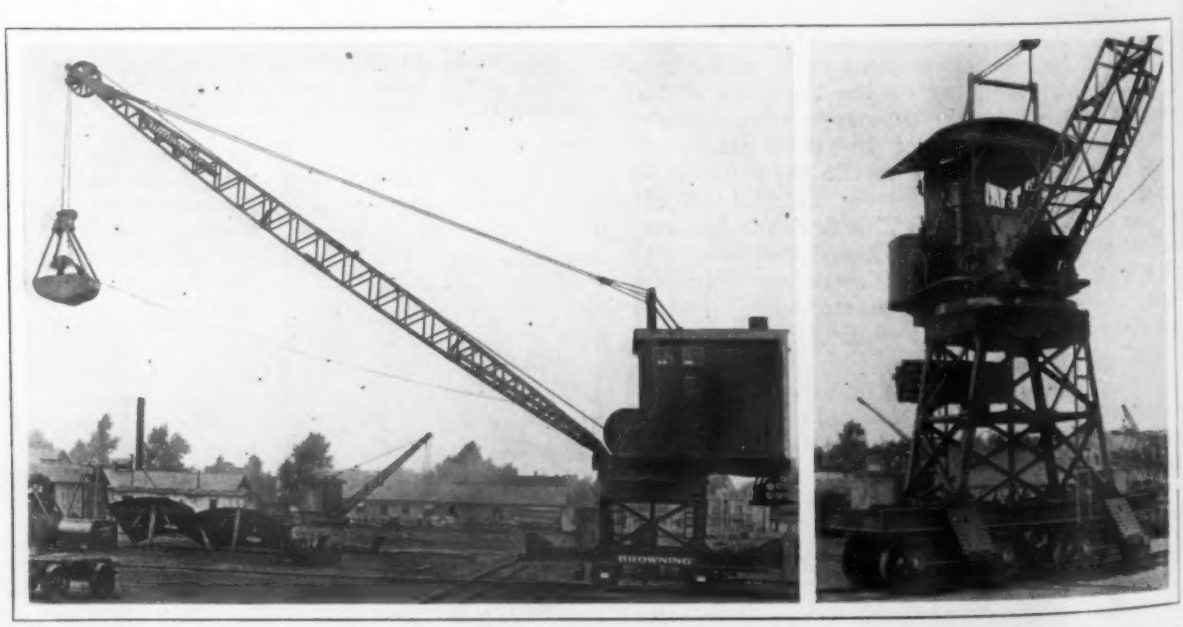
Special high grade, heat-treated and hardened steel is used for the gears which are mounted on ball bearings. They are fully inclosed in the gear case at the end of the motor and revolve in grease and an aluminum plate separating them from the motor housing is relied upon to prevent oil and grease from getting into the windings. The bearings used on both ends of the armature shaft are of the annular type, while the spindle thrust is taken by a thrust bearing. The bearings carrying the armature shaft are arranged so that the outer race is held in place by a threaded nut, and the inner race of the bearing is locked to the armature shaft, this arrangement tending to assure a positive drive and to overcome friction. The grease in the gear case at the end of the motor serves as a lubricant for the spindle and thrust bearing as well as the ball bearing at the lower end of the armature shaft, the gears in their rotation forcing the lubricant through canals leading to the bearing. The grease can be renewed when necessary without dismantling any part of the machine by removing a plug at the gear end of the motor. The annular bearing at the top of the armature shaft has a special grease cup.

The switch is of the quick make and break type and is under immediate control of the operator. Carrying capacity for taking care of any overload on the motor is provided. A special type of slip socket bored to conform to the Morse taper is used, thus doing away with the drift key and holes in the spindle and spindle bearing. In this way, it is pointed out, dirt and borings are not likely to get into the bearings.

Locomotive Cranes for France

A large number of American locomotive cranes of special design are being built for France for use in handling freight from boats to the docks and for coaling engines along various railroad lines between northwestern France and Marseilles. The cranes are being furnished by the Browning Company, Cleveland, Ohio, to Chemin De Fer D'Etat.

The standard American locomotive cranes could not be used as they are so low that there is not sufficient clearance for them to swing on the French railroad tracks with cars on adjoining tracks, the tracks being laid closer together than the usual American practice. The requirements for some of the cranes called for sufficient height to allow a clearance over the tops of cars so that the material could be handled on tracks not directly adjoining the one on which the crane is located. When the



Two Locomotive Cranes, Mounted on Structural Steel Frames to Provide the Clearance Required for the Rear End Swing, Which Have Been Shipped to France

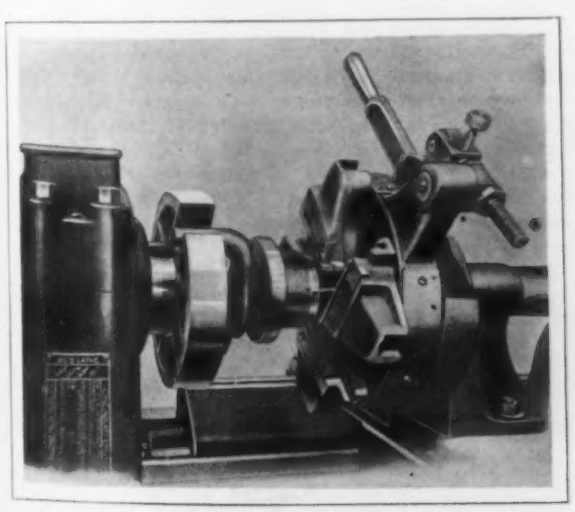
order was placed the builder was furnished with dimensions and allowed to use standard parts and standard construction as far as possible and, roughly speaking, the cranes can be said to be about 90 per cent standard.

The crane in the larger section of the accompanying illustration is what is known as a 3-meter crane, from the fact that the clearance of the rear end swing is 3 meters. This is a four-wheel machine with a special car body which allows the couplers to couple to the standard freight cars of Europe. The rotating base, machinery, drum, boilers, operating levers, etc., are carried on a structural frame as shown, which provides an elevation to secure the required clearance. The boom is 50 ft. in length and handles what is practically a 1 cu. yd. Browning reeved type of clamshell bucket. This bucket although of a light construction will bury itself in ordinary coal when reeved on a three-part line.

The other crane is a 5-meter locomotive unit of a larger type, which is mounted on a double truck. This differs from the one described above in that the car body is supported by two four-wheel swivel trucks with a structural section, between the car body and rotating base, 2 meters higher than the other type, bringing the rotating platform 5 meters above the track. This crane is equipped with a 1¾ cu. yd. clamshell bucket. The photographs of these cranes, which were taken before shipment, show axles used as counterweights. When in actual service cut steel rails will be used for counterweights, completely filling up the space provided for that purpose by rods suspended from the rotating platform.

Die Head for Threading Shrapnel Parts

A stationary type die head, designed for use on engine or turret lathes for threading the base and fuse plugs of shrapnel shells has been brought out by the



A Die Head for Threading the Base and Fuse Plugs of Shrapnel Shells Mounted on an Engine Lathe

Landis Machine Company, Waynesboro, Pa. When the head is used on an engine lathe it is bolted to a bracket and is supported on the cross-slide guides while for turret lathe use, the head is equipped with a shank to fit in the hole of the turret.

The head is manually operated by a bell-crank lever and is locked in the closed position. The design is compact and steel is used throughout. The chasers are of the maker's standard type and are furnished either with short throats or without any throat at all so that a full thread may be cut up to the head of the plug.

The New England Labor Situation

The public investigation of the labor situation in Worcester, Mass., last week, by the State Board of Conciliation and Arbitration, brought about no change in the condition of the struggle in that city. A great mass of evidence was submitted by both employers and employees and is now under consideration by the board. The manufacturers refused to enter into any form of arbitration, although without exception the employees expressed a desire for this form of settlement. The employers stated their conviction that industrial peace was impossible as long as the labor leaders from outside remained in the city. The Crompton & Knowles Loom Works officials, at the request of the board, held another conference with the employees Oct. 22, but offered no compromise and, at a meeting later in the day, the latter voted to go out Oct. 28, to enforce their demands, which are the same as those submitted to the other shops of the city. There is so far but little evidence of weakening by any of the parties to the controversy.

A portion of the employees of the Union Twist Drill Company, Athol, Mass., walked out Oct. 18, when their demands for an 8-hr. day and an increase in wages were refused. It is expected that the State Board of Arbitration will take a hand in the controversy.

The strike at the plant of the New Britain Machine Company, New Britain, Conn., has been declared off by vote of the strikers.

An effort by the Hartford Chamber of Commerce to bring about a settlement of the strike at the plant of the Pratt & Whitney Mfg. Company, Hartford, Conn., has not been successful. In refusing to meet a committee from the chamber, Vice-President B. M. W. Hanson of the Pratt & Whitney Company sent a letter in which he respectfully declined to discuss the affairs of the company with anybody not in the company's employ. He stated that a large number of workmen on strike have returned, and they as well as the workmen that stood by the company have expressed their appreciation of the company's treatment of its employees in several interviews, and he believes this is the sentiment of the majority of the strikers when left to their own judgment.

The machinists employed in the mills of the Ludlow Manufacturing Associates, Ludlow, Mass., on Oct. 19 demanded shorter working hours and a readjustment of wages. Through the efforts of the State Board of Conciliation and Arbitration a compromise was reached on all the demands except an increase of 25 per cent in wages. It was agreed to leave the settlement of this point in the hands of the board.

The strike at the Duckworth Chain Company, Springfield, Mass., has been settled by a compromise agreement. In substance, the agreement is for a 48-hr. week with pay as previously paid for 54 hr., time and a half for overtime and double time for Sundays and holidays. All women employees shall receive a minimum wage of $8 a week after six months' experience, and the wages of piece workers shall be adjusted so that they will earn this minimum. All matters which cannot be settled by the foremen or the shop committee shall be submitted to the State Board of Conciliation and Arbitration, whose decision shall be final. No provision is made for a closed shop or for open recognition of the union.

The labor agitators are still active in Providence, R. I., but no additional shops have as yet been affected. The strike at the Brown & Sharpe Mfg. Company's plant is practically ended, as most of the men are back at work or have left town. In the trouble at the Builders Iron Foundry, the molders are asking for different terms from those of the machinists. The 8-hr. movement in Providence seems to be falling to pieces.

The Central Steel Company, Massillon, Ohio, has established a sales connection in Cleveland with the Hamill-Hickox Company, Hickox Building, which will handle the sale and distribution of Central Steel products in Cleveland and its immediate vicinity.

Safety Convention at Philadelphia

How the Movement for Safeguarding Employees Has Grown Illustrated by Size of National Safety Council—Meeting of Foundry Section

A registration of over 1100; an attendance which probably exceeded 1500 in the numerous sessions which it held simultaneously, and an intensity of interest unusual for the meeting of a more or less technical society tell something of the remarkable growth and widening scope of service which the National Safety Council has reached in its three years of existence. The recognition of the special safety problems attaching to a given industry were shown this year in the arrangement for special sessions for these several industries, and so numerous was the representation of these industries and so urgent the demand for the specialization that an iron and steel section, for example, was organized this year. The meeting was the fourth annual of the National Safety Council and was held in the Bellevue-Stratford Hotel, Philadelphia, Oct. 19, 20 and 21.

It is probable that in all 100 papers and reports were read. Such interest was manifested that one of the more general sections devoted to the safeguarding of machinery, of which section Robert J. Young, manager of the department of safety and relief of the Illinois Steel Company, Chicago, was chairman, had to be continued from the one day to the other. A reference to the different sections and a list of the papers were given in THE IRON AGE of Sept. 23.

On Thursday morning was held the section devoted to foundry safety problems, with Dr. Richard Moldenke, Watchung, N. J., as chairman. This section like others was exceptionally well attended, and an idea of the caliber of the proceedings may be obtained from the subjoined brief account of that particular section. The present convention brought about the consummation of definite organizations for each section, each to have its own officers and committees and thus to pay attention to its own problems. So far as the foundry section is concerned the following were elected to serve the ensuing year: Chairman, O. J. Fehling, manager National Malleable Castings Company, Chicago; vice-chairman, F. G. Bennett, safety department, Buckeye Steel Castings Company, Columbus, Ohio, and secretary, Earl B. Morgan, safety engineer, Commonwealth Steel Company, Granite City, Ill. The scheme of sectional organization includes four standing committees, as follows: Membership, standardization, the causes and remedies for hazards, and a program committee.

NEW OFFICERS

At a banquet which the National Safety Council held on Wednesday evening, at which speeches were made by the Governor of Pennsylvania and the Mayor of Philadelphia among others, the new officers for the ensuing year were announced. R. W. Campbell, chairman of the Central Safety Committee of the Illinois Steel Company, who has been president since the inception of the present movement, could not be induced to retain the office longer and the new president is Arthur T. Morey, assistant to the president of the Commonwealth Steel Company, Granite City, Ill. Lew R. Palmer, chief inspector of the Department of Labor and Industry of Pennsylvania, Harrisburg, Pa., was re-elected first vice-president; C. W. Price, assistant to the Wisconsin Industrial Commission, Madison, Wis., was made the second vice-president, and Edwin R. Wright, president of the Chicago Typographical Union No. 16, was re-elected third vice-president.

W. H. Cameron was re-elected secretary, and in making the announcement retiring President Campbell paid special tribute to him for his efforts in behalf of the society. Marcus A. Dow, general safety agent of the New York Central Lines, was elected director of the exhibits and J. J. Lamont was re-elected assistant secretary. As a recognition of the fact that the National Safety Council grew out of the safety activities of the Association of Iron and Steel Electrical Engineers, that association was elected to honorary membership through admitting to that grade its executive officer.

The new president in his capacity as attorney for the Commonwealth Steel Company and in the investigations incident to the application of workmen's compensation law to the works of the Commonwealth Steel Company, emphasized the desirability of working especially to minimize accidents and in this met the hearty approval of President Howard of that company. As a result, his work as assistant to the president of the Commonwealth Company has resulted in his paying special attention to the elimination of accidents and general safety and sanitary provisions in the works. The company showed in the general exhibit room conducted by the National Safety Council that it had reduced accidents through safety work as much as 69 per cent. Mr. Morey is one of those who believe it possible to eliminate the remaining 31 per cent.

In this connection mention may be made of a list of notable reductions in percentages of accidents shown in the Council's exhibit. These are arranged alphabetically as follows:

Bucyrus Company, S. Milwaukee, Wis.	65
Commonwealth Steel Company, Granite City, Ill.	69
Illinois Steel Company, Chicago	85
Inland Steel Company, Chicago	35
Jones & Laughlin Steel Company, Pittsburgh	78
A. J. Lindeman & Hoverson Company, Milwaukee	62
Packard Motor Car Company, Detroit	72
Pullman Company, Chicago	46
Raritan Copper Works, Perth Amboy, N. J.	22
U. S. Steel Corporation	41
Wisconsin Steel Company	38

Foundry Safety Meeting

In opening up the meeting of the foundry section Dr. Moldenke paid a tribute to the work in safety of the late Thomas D. West. He ventured the opinion that one reason why there is a greater loss of life through accidents in this country than in industrial plants abroad is a psychological one. This is a country in which great emphasis is placed on the individual, that the individual relies on himself; and in a measure the situation is one described as the survival of the fittest. Now the weaker brother is protected by legislation and the employer has become interested, he added. He emphasized that much depends on the foremen in a shop; that in the promotion of safety these men must be interested if the well-being of the establishment is to be considered by all,—the executives and the workmen.

SAFETY MEASURES IN COMMONWEALTH PLANT

The first paper was read by Arthur T. Morey, the new president of the National Safety Council. He early emphasized that in the plant of the Commonwealth Steel Company safety is regarded as a production matter. Costs on this account are charged against the cost of manufacture. At the outset an independent appropriation of $20,000 was made, as otherwise it would be too severe an item for production to carry, but now such is not the case and the burden is placed where it belongs and puts some pressure on operation.

One of the things that were done to bring order out of chaos in the plant was to lay down a brick walk extending lengthwise through the foundry, which is about 875 ft. long. The molding floors were trued up to this and now everything has a place and there is no stumbling over materials and equipment, nor waste of time looking for tools and apparatus. Railroad tracks are used for transporting cores; there are boxes for facing

sand and the like. The number of accidents has decreased and the efficiency of manufacture has gone up.

He urged that a satisfactory working system of signals between operators and chain men needs to be developed. The wearing of goggles has ceased to be a problem, even in hot weather and with the ladle men. He referred to some protective measures, which were recently illustrated in a bulletin of the National Associated Safety Organizations, such as a glass protective shield for the open-hearth furnace charging machine and a method of diverting downward the sparks incident to the outflow from a cupola. He mentioned also the use of a protective platform now available built of fireproof boarding for patching up the roof of an open-hearth furnace. Safety, he said, dovetails right into efficiency; the study of safety is a study into the right way to do things. He holds that an accident indicates that somewhere there is inefficiency. In the discussion he mentioned that an electric magnet is used for picking up the little things and this is so effective that iron articles are pulled through 6 in. of the foundry floor.

SAFETY IN HANDLING MATERIALS

A paper on the handling of materials by A. L. Clark, superintendent Western Foundries, American Brake-Shoe & Foundry Company, Chicago, brought out some figures on the loss of time by men due to accidents in handling materials, which he said was the source of 77 per cent of the accidents. The figures, which were brought to the attention of the workmen, showed how the men through accidents are losing more than the employers.

Dr. Moldenke mentioned that there are over 6000 foundries in the United States and that perhaps of these not more than 250 could be regarded as practically up to date, a figure which is calculated to indicate in how large a number little or no attention is as yet being paid to safety matters. Mr. Morey felt that a bonus was a difficult thing to award for efficacy in safety work, as it is impracticable to compare different departments of a shop with regard to the accident hazard, let alone different shops, and that instead of a bonus a bogie could be set up for each shop as a standard.

EYE PROTECTION

A paper was read by F. G. Bennett, safety department, Buckeye Steel Castings Company, Columbus, on "Eye Protection." He urged the issuing of goggles from one central source and that care be taken to see that they fit the individual. Mr. Morey had found antisweat pencils expensive and his chemist had developed a formula for a substitute at a cost of almost nothing, and he promised to give any one the receipt who sent to him for it. Others suggested the use of soap, and the sterilization of goggles was also discussed. In the General Electric Company when the goggles are turned in they are disinfected in a bichloride solution, sometimes after scrubbing, and sometimes they are treated with tincture of iodine. A representative of the American Steel & Wire Company, Pittsburgh, mentioned the use of formaldehyde and also one hour's immersion in alcohol, and a representative of the American Car & Foundry Company advocated live steam for sterilization.

The subject of protection of the eyes in the case of oxy-acetylene and electric arc welding was also brought up, and Mr. Morey mentioned the plan of inclosing this department in opaque partitions with a door fitted with the proper combination of colored glasses to protect the eye and yet satisfy human curiosity.

HAND, FOOT AND LEG PROTECTION

A paper on hand and foot protection was read by B. W. Conlin, safety inspector National Malleable Castings Company, Chicago. He referred to the use of hand leathers for handling castings with sharp fins, for example, and the practice of supplying a lotion to workmen to minimize chapping of hands, which chapping tends ultimately to open the skin and give opportunity for the poisoning of the body. He mentioned also the desirability of shin guards for varicose veins of the leg. In the discussion it was brought out how so many foundrymen with imposing physiques above the waist line have commonly poor legs and flat feet, and that something ought to be done to look to their protection in relation to varicose veins and the use of shoes to prevent flat feet, particularly in the case of the young men entering on foundry work.

Mr. Bennett referred to a formula in the possession of the Underwriters' Laboratories, Chicago, for rendering legging material fireproof. Some reference was also paid to foundry shoes with an inner reinforcement to the toe cap, which had proved very efficacious in a number of cases where heavy articles falling on the foot had resulted in little or no injury. A case was mentioned of the use of leggings reaching practically to the hip so that it mattered little what type of pants the men wore.

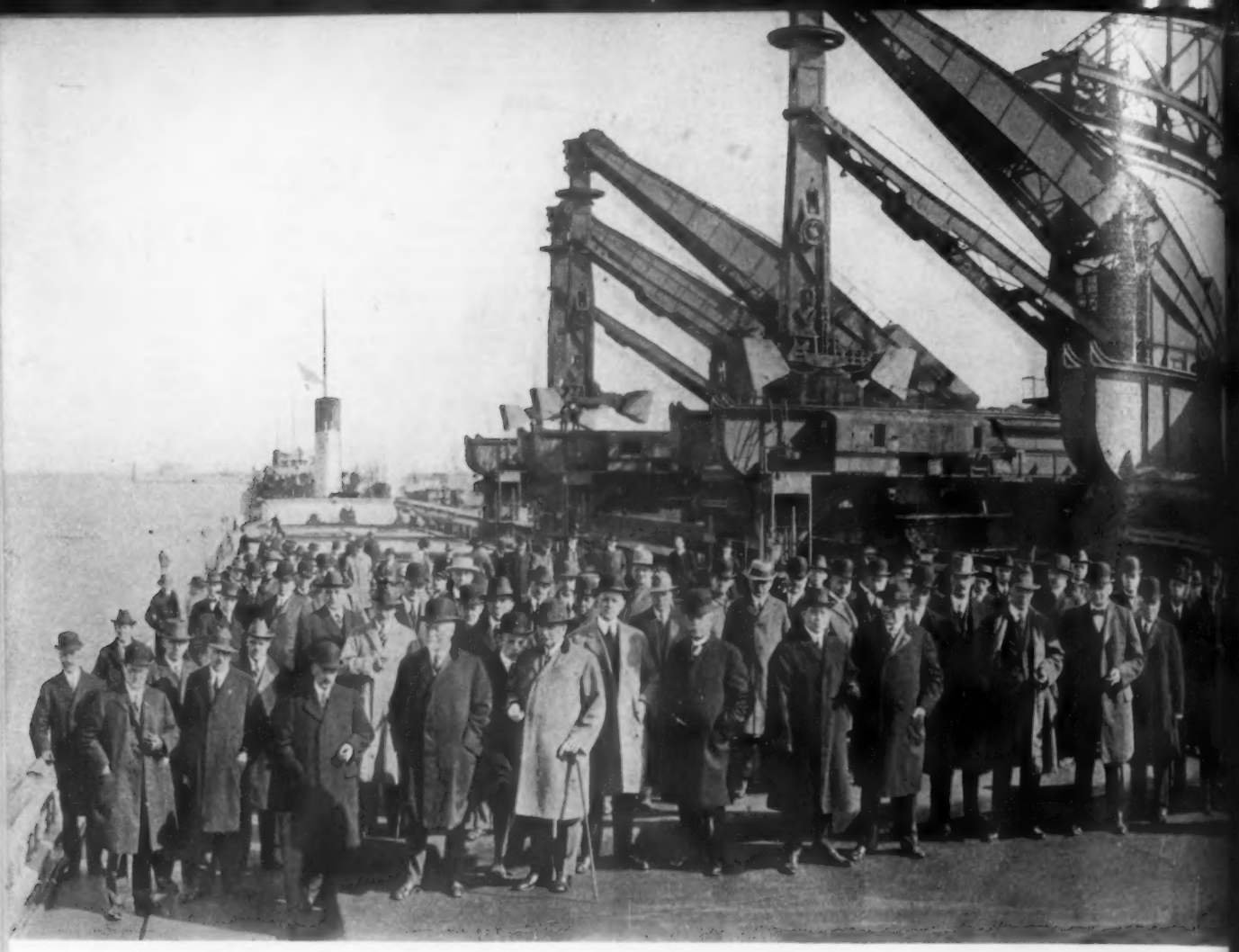
R. W. CAMPBELL

W. H. CAMERON

ARTHUR T. MOREY

OFFICERS OF THE NATIONAL SAFETY COUNCIL

After serving as president since the organization of the National Safety Council, Mr. Campbell, of the Illinois Steel Company, retires and is succeeded by Mr. Morey, of the Commonwealth Steel Company. Mr. Cameron, formerly of the American Steel Foundries, remains as secretary-treasurer.



Copyright, 1915, by I. A. Miller, Cleveland, Ohio

Members of American Iron and Steel Institute on Deck of Ore Boat J. Pierpont Morgan, the

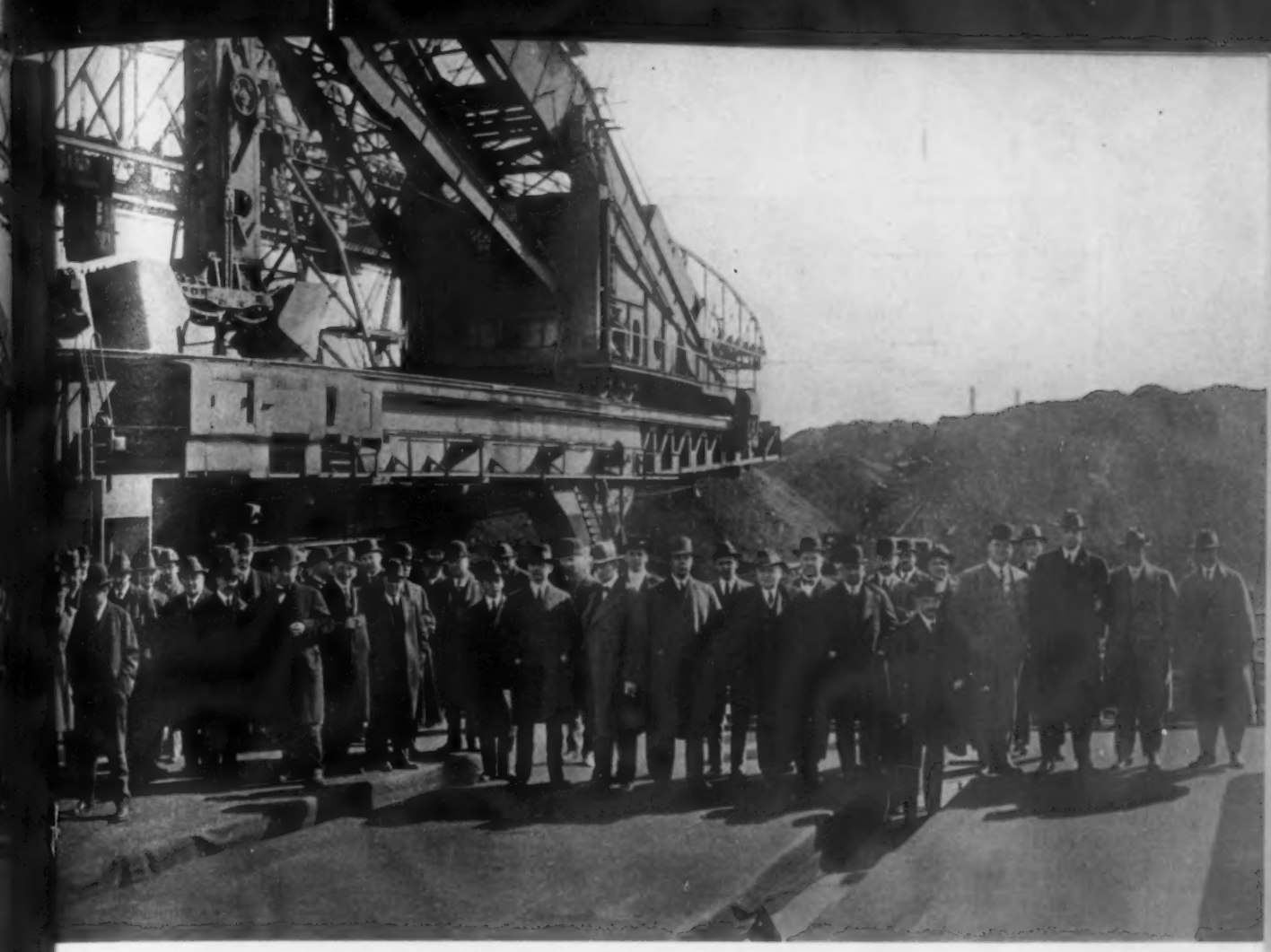
Cleveland Meeting of American Iro

Peace Desired More than Profits—Publicity and Prepar Invasion after War to Call for Protection—Papers Printed

THE visible evidence of what the American Iron and Steel Institute is becomes increasingly impressive with each meeting. The attendance, which at the Cleveland meeting, Oct. 22 and 23, mounted nearly to the 700 mark as compared with a previous high record of about 500, though itself a factor, is but a background against which the personality of individuals, unique in the magnitude of their collective authority, stands out in relief. A few of the faces for which one is accustomed to look were missing, but in the new membership a commanding show of strength was presented.

Cleveland does not lack reputation for its hospitable reception of the visitor, and the arrangements provided for this meeting were all that the time of two days could be made to yield in enjoyment and cordiality. President Gary's address early struck the note, which, apart from purely technical matters, frequently recurred as the prevailing thought of the meeting, when he referred to the war in Europe, its tremendous present cost and after-burden, the horror of it all, its effect thus far upon the commercial interests of this country, and the probable eventualities at its close. In one form and another, remarks throughout the entire day reflected the belief that while business founded upon the manufacture of war materials would doubtless continue to be pursued so long as it was demanded, the business men of this country would gladly bring the struggle to a close to-morrow without a thought of profits, were such a termination possible. The warning was sounded that the ending of the war must necessarily bring with it a period in which the industry of this country will be in need as never before of protection against European commercial encroachment, an aggression founded upon low wages and a crying need to market its products.

The technical papers presented at this meeting again emphasized the wide survey, the breadth and accuracy of information and the co-operation incident to their preparation, maintaining standards which have become the rule. The liberality of viewpoint which now makes accessible to the writers of papers the most detailed and intimate facts in the experience of a large number of competitive organizations was the occasion of frequent congratu-



Ore Unloaders at Pennsylvania Docks, Cleveland, in Background and the Mountain of Ore at Rear

and Steel Institute Tinged by War

ess Regarded as Preventives—European Commercial
ull as Presented Last Friday, Together with the Discussions

latory comment. The length of the program proved to have been admirably regulated to the time available. The reduced number of papers over former meetings and the prepared discussions contributed to a sustained interest and to timely conclusions, perhaps the best thus far attained. President Gary's address, an address by Samuel Mather and the papers and discussions follow:

Judge Gary's Presidential Address

Taking "Publicity" as his theme, President Elbert H. Gary, delivered at the opening of the meeting, the following address:

The public be damned.

Many years since it was openly charged that this expression was used by a business man of great prominence. There has been a prevalent belief that the charge was based on fact and it has caused a feeling of prejudice which has been exceedingly harmful to the business interests of the country.

It is doubtful if the statement was ever made by any one of great importance, particularly by the gentleman to whom it was attributed. Whatever the truth may be in regard to this well-advertised and much-discussed expression, it is no doubt true that the sentiment which it conveys has in days gone by existed in the minds and actuated the conduct of a considerable number of the leading business men of this country and other countries during various periods of their history. Included in this class are men of intelligence and influence in all the various departments of industrial activity.

Within a few years, comparatively speaking, we have listened to the arguments of distinguished business men who insisted that if they violated no rule of law, if they withheld from the public nothing which the law positively and affirmatively compelled them to disclose, they were without fault, even though a large portion of the public might be adversely affected by a failure to reveal information which might be received in an official or fiduciary capacity or as the result of circumstances which gave to an individual a decided advantage over others. Most of us know of cases where officers of corporations have acquired wealth by acting for themselves to the prejudice of others who were interested and were not in a position to protect themselves because of the lack of publicity. Some have dealt, to their great advantage, in the markets of the world upon advance knowledge of what might be expected as the outcome of conditions or facts not gen-

J. H. Sheadle, Cleveland-Cliffs Iron Company, at Left; Samuel Mather, Pickands, Mather & Co., at Right

erally known at the time and before the facts were communicated even to the other stockholders. They violated no rule of law and, probably, in their opinions, no rule of moral conduct. This is a charitable view to take.

It has in the past been considered by men of probity and high standing that private corporations, so called, as distinguished from public or quasi-public corporations, were literally private and that the public had no greater right, legal or moral, to inquire into the affairs of the corporation than it had to question the personal matters of the individual or family. Sometimes the management of corporations, including the boards of directors, have withheld from the general public facts which directly affected the public interests, and even though no rule of law was violated yet widespread harm was done. In many cases men of prominence and influence have been totally indifferent and defiant when considering the public welfare.

It is needless to say that, because of this attitude on the part of some of the business men, the whole fraternity has been seriously affected and has suffered unjustly. For a period of years big business, so called, the good with the bad, was antagonized to an extent which materially interrupted its normal and legitimate progress; and it is believed this was occasioned in part by the suspicion created from the failure to take the public into the confidence of private enterprise so far as practicable and proper.

The general public and private individuals have been in the past too far apart for the good of both. Lack of knowledge often breeds unnecessary and hurtful antagonisms, and many have suffered even though they were not personally at fault.

PRINCIPLES OF PROPER PUBLICITY

These casual remarks are preliminary to a brief discussion of the topic of publicity which is one of the most important questions of the day. Much has been said and written upon the subject during the last few years, and apparently there have been contrary opinions. It is believed, however, that there is really not much difference in the minds of intelligent and fair-minded men as to what is desired, although in the consideration of any important question there will be found those of extreme views who, on one side or the other, will insist upon that which is unreasonable. If the public is approached in a fair spirit it will generally reciprocate.

There are from time to time many facts in private business, some of great importance, which cannot properly be made public and ought not to be insisted upon. All who are present know by actual experience, and every other intelligent person will recognize the fact, that in current business affairs, where competition is essential, there are always a great variety of questions which must be treated as private and withheld from publication in order to stimulate business and accomplish success. This is and will always be the rule, though there may be exceptions to meet the exigencies of special conditions. If a man in business should open every detail to the inspection of all others he might seriously interfere with his own progress and benefit no one, except such as might be disposed to profit unfairly at his expense; while, if he declined to disclose these private matters, nobody would be injured. Neither the public nor any one except the individual person or corporation involved is entitled, on any ground, to possess the kind of information now under discussion. It is not necessary to specify the facts pertaining to individual affairs which are strictly private; any man may apply the principle to his own matters. Perhaps it is impracticable to draw a definite line between the facts which should be given to the public and those which may be considered private; and quite probably there should be an impartial public tribunal to determine, but this is another question. "The public" as used might comprise large or small numbers.

It is not practicable to determine a standard for publicity which is exact and applicable to all cases. Circumstances and conditions must be considered; but a general rule may be stated thus: There should be published whatever of business matters the public is legally entitled to know and also whatever may affect the public interest and may be exposed without detriment to the corporation or individual concerned.

PROPER LEGISLATION REGARDING PUBLICITY

Legislation or administration of laws or any practice of governmental agencies that seeks to go further than this rule is vicious and should be condemned. I believe thoroughly in publicity, so far as it is practicable and proper. We should not be like owls. It should go without saying that the officials of a corporation ought to keep the stockholders promptly and fully informed, so far as possible, without damage to its current business. They have no moral right to profit individually to the detriment of other stockholders as the result of information officially obtained.

However, during the present decade there has been a pronounced change in the attitude of large business interests concerning the disclosure of facts and figures to the general public. Many now, voluntarily and without the requirement of law, make regular and complete reports so that any one interested may know the results of the business and the general policy of the company; and whenever requested by representatives of the press they furnish facts in corroboration or denial of rumors which are considered important, when the information can be given without prejudice to the business and appears to be of concern to the public. Probably it will not now be denied that the average business man is quite disposed to be accommodating in this respect.

WISDOM OF REASONABLE PUBLICITY

And what follows? It will not be questioned that the great business interests of the country have been benefited by this change in disposition toward the public, which has become less distrustful of capital and its controlling influences. It has been more considerate of the rights and claims of those engaged in great enterprises and less inclined to listen to the plea of the demagogue. Indeed, it has patiently and fairly heard and read all that has been said in favor of granting relief to any concern that sought assistance on a fair and reasonable basis; and not infrequently, because of a public sentiment that the request was just, it has been granted. Included among those who have seemed to change their opinion toward the business interests are multitudes of wage earners, of business men of small means, of educators, lecturers and editors, of the leading thinkers, writers and public speakers of the country. There is abundant evidence that at present the great general public is willing to meet half way the individual or the corporation in the determination of all questions that affect private or public interests.

Is it too much to urge that from every standpoint it pays the business man, or any man possessed of in-

formation which affects the public weal, to disclose the same so far as practicable and reasonable? Is it too much to insist that publicity is the cure for many of the ills from which the country has been suffering in the past? Publicity has never done as much harm as secrecy. The individual or the corporation with a disposition to publish whatever facts were proper to be known has, without many exceptions, been treated justly; while those who have been defiant, arrogant and secretive have suffered. So far as I can see, the great business men of this country are, at the present time, in close contact with the public. They are striving to work together for the good of all. We shall see great and favorable results.

PROPER PUBLICITY BY PUBLIC OFFICIALS

These observations relating to private men and enterprises apply with equal force to public officials, to municipalities, states and governments. The public is entitled to know what public officials are doing and what policies are being considered or enforced, though, of course, it may, and often does happen, in individual cases, that information cannot be generally given out without injury to the cause involved; and in such cases the responsible official must withhold publicity temporarily, and, possibly, in some cases, permanently. It is fair to say, public officials have often been as indifferent to the rights and interests of the general public as private officials or persons have been. It would be better for all concerned if the officials of municipalities and even states and countries were more inclined than they have generally been to confide the knowledge in their possession to the people at large.

WOULD HAVE PREVENTED PRESENT WAR

This idea has peculiar application to the present situation in Europe. If the masses of the people of the different nations engaged in the terrible conflicts that are now waging in Europe were fully informed of all the facts, is it to be supposed the wars would be much longer continued? If they and every one of them, in the armies or at home, knew, as now published in our newspapers, that the daily cost of the war is eighty-five million dollars, or at the rate of thirty billions per year, an annual interest burden, at five per cent, of one billion five hundred million dollars, and that the indirect loss is about as much more; if they were aware that, on the basis of the war being prolonged to next February, there will have been killed in battle at least five million men, deaths from sickness two million five hundred thousand, and permanently crippled five million more—and these the very best; if they could see that seventy-five per cent of the men in the armies who survive will never fully recover, physically or morally, from the effects of their service and association; if they realized that their countries are drifting, nay, speeding, into bankruptcy and must necessarily hereafter and for many years be at a decided disadvantage in the race with other nations for progress and success; if they understood that on the present basis of pension payments in the United States the amount to be paid for this purpose in consequence of the war will approximate one billion dollars per year; if the leaders, the monarchs, the few who plan and control and command and know in advance and in detail what has been and is being done and is intended for the future, were to communicate all the facts to the public, when it could be done without prejudice to the daily conduct of the war; if all these startling facts and figures were of universal knowledge, would not the people, including the soldiers in the ranks, rise up in such vigorous protest against a continuance of the conflict as to compel the men in control to find some way of bringing it to a satisfactory termination and for the establishment of a basis which would prevent future, prolonged wars? If, indeed, before the wars were started the masses of the people of the different countries had been informed that wars were to be started, and the reasons or lack of reasons for starting them, would they have submitted to their precipitation?

It is not too much to demand that the people should know the reasons for the commencement and the continuance of the pending wars and they should understand the awful consequences. Those who are directly affected and must bear the burdens are, in a large measure, ignorant of the facts which have been suppressed, partly at least, because knowledge of those facts would prevent a continuance of the most stupendous, if not the most unreasonable, destruction of life and property the world has ever witnessed.

Julian Kennedy, Pittsburgh, at Left; D. T. Croxton, President Cleveland Furnace Company, at Right

I leave this subject by proposing as a substitute for the quotation referred to at the beginning of these remarks the following from the Bible (Romans XIV:7):

> For none of us liveth to himself, and no man dieth to himself.

PRESENT BUSINESS CONDITIONS

The business men of this country, particularly those engaged in the iron and steel trade, have reason to be thankful for the present conditions, which are very prosperous. The furnaces and mills are generally operating to full capacity and prices received for many, if not most, of the commodities produced are larger than they have been during the last few years and should result in profits.

We are at peace with all the world and it seems likely that the wise policy which has permitted this state of affairs will be continued. We sincerely hope and pray that the wars which are raging in Europe may soon be brought to a close and a basis reached for the prevention of prolonged wars in the future.

Apparently we are to have a period of industrial peace in this country. Many of the antagonisms, which have hitherto been so hurtful and which have prevented natural business growth, have disappeared and legitimate business will, therefore, have opportunity to progress in accordance with its deserts.

No doubt the sudden and marked improvement in conditions during the last six months is due, in a large measure, directly or indirectly, to the purchasing of necessities growing out of the wars; but there are other reasons.

THE FUTURE OF THE UNITED STATES

The total wealth of the United States, according to the last published figures, is more than one-fourth of the aggregate of all the nations and it is rapidly increasing. Many of us believe that we may become and remain the leading nation, financially, commercially and industrially, provided nothing unnecessary is done by our people to prevent. Personally, I do not agree with the statements which have been made that, at the close of the wars, we may expect in this country a prolonged continuance of the great prosperity now experienced; especially if we do not have protection against the results of cheap labor and the impoverished conditions abroad, which are inevitable. I do think that,

A. W. Thompson, president Inland Steel Company, Chicago, at Left; George H. Jones, vice-president Inland Steel Company, at Right

with wise administration and with the co-operation of the State and National Governments, our industries will be able to recover from the injurious effects of the wars much more rapidly than those of any other country, and that within a few years we shall be more successful than ever before.

The value of good crops we all understand and appreciate. Evidently the season's crops are, in most respects, excellent and with a good market therefor the farming communities will be prosperous and the country at large will be benefited.

The American Iron and Steel Institute is to be congratulated on the good work it is doing and the high reputation which it deserves and has secured and particularly on the splendid services which are being rendered by the young men, including those who are producing at our meetings, for our benefit, most admirable discussions of various topics which directly affect our industry.

The Industries of Cleveland

Samuel Mather, chairman of the local committee, and senior member of Pickands, Mather & Co., representing Cleveland, followed the presidential address with a review of Cleveland's position among the cities of the country, from a standpoint of manufactures and traced the events, with their related significance, which had contributed to this development. Mr. Mather's address was particularly illuminating and interesting. In the value of manufactured products, Cleveland ranks fifth among the cities in this country.

Historically he referred to the incorporation in 1834 of the Cuyahoga Steam Furnace Company, "the first iron industry in Cleveland or vicinity to use steam instead of horse power for blowing its forges and furnaces. . . . In 1882 the first iron lake steamship intended for the carrying of ore and grain was built in Cleveland by the Globe Iron Works and called the Onoko." It was undoubtedly owing, Mr. Mather stated, to the discovery of copper and, more particularly, iron ore in the upper peninsula of Michigan, which latter was first discovered Sept. 19, 1844, at the Jackson mine, Negaunee, and the opening of the Sault Ste. Marie ship canal in 1855 that contributed most to the great growth of Cleveland, for this city then became the natural meeting place of the bituminous coal from the coal fields of southern Ohio, Pennsylvania and West Virginia, and the iron ore from the Lake Superior district.

The iron and steel industry now ranks first in the value of manufactured products, he added, a total of $76,000,000, involving employment of over 28,000 men. "While it is interesting to note that next in rank to iron and steel comes the automobile industry, which, against nothing reported in 1900, showed a value of products in 1910 of $21,400,000." In this remarkable industry Cleveland stands second.

At Cleveland there are ten blast furnaces with an average output of 120,000 tons monthly, while the variety of its finished manufactures has led to its being called the Sheffield of America and "the city of varied industries." The statistics of 1910 show that Cleveland produces considerably more than 2000 different kinds of manufactured articles, in 2148 establishments, engaging approximately 100,000 wage workers, with the manufactured products valued at $272,000,000. Mr. Mather closed his address following mention of the activities of the Cleveland Chamber of Commerce with a reference to Cleveland's group plan. He said, "Lastly, I wish to speak of Cleveland's group plan, which reflects the progressive spirit of the people, as our city I think was the first in America to undertake the erection of its public buildings in a related group."

Methods of Burning Blast Furnace Gas

The first technical paper of the meeting was presented by Ambrose N. Diehl, assistant general superintendent Carnegie Steel Company, Duquesne, Pa., in which were compiled the results of an investigation of modern methods of burning blast furnace gas under stoves and boilers. The author said that the problem of investigation was made difficult because of the lack of accurate data among those using blast furnace gas. The paper was, therefore, based largely upon tests made of stove and boiler operation. This lack of information as to the efficiency of gas burning under boilers, may be attributed in the first place, he suggested, to the comparatively small saving which it has been thought resulted from increased boiler efficiency, in cents per ton of iron, and also for the reason that gas used under the boilers is ordinarily excess gas. The paper was prefaced by a résumé of the constituents of blast furnace gas under considerations involved in its use.

In considering the efficiency of a burner, it is essential, he explained to distinguish between the performance of the burner itself and that of the combined unit, consisting of the burner and stove or boiler. It is also necessary to accept some standard of burner efficiency, and the paper outlined a basis of 100 per cent efficiency, which serves as a standard of comparison. This definition is given as follows: "A gas burner is operated at 100 per cent combustion efficiency when the analysis of a sample drawn from a point 2 ft. beyond the point of ignition, shows perfect combustion." A calculation is then worked out showing the method for determining any burner efficiency from which a numerical comparison of various burners can be made.

Mr. Diehl abstracted his paper in presenting it, but as early as possible, the paper will be published in THE IRON AGE in considerable detail. The paper classified burners into six types and described each. The application of burners to hot blast stoves was first considered, and a record of a number of tests at various plants was given in detail. A similar treatment of gas burners for boilers followed.

After pointing out that most of the tests made fail to show data in which the burner was isolated from the boiler or stove, it was suggested that the data collected could scarcely serve as more than a basis for study and adaptation to local conditions. In general, stack analysis in a stove test is indicative of the burner mixing efficiency, while the stack temperature indicates the quantity of gas burned, bad heat distribution or quantity of absorption surface. Of boilers the same is not true, as air infiltration in ordinary boilers is quite extensive.

In concluding, Mr. Diehl said, "Further I wish especially to call attention of the Insitute to the kindness and courtesy of the various managements of not only the plants quoted, but of many others to whom I applied for information. The invariable answer 'We will give you everything we have,' expresses most forcibly the change of attitude among manufacturers within the last few years, and demonstrates a mutual desire for more extensive information. Too much credit cannot be given the Institute for its share in the accomplishment of this result, and if this paper fulfills no other purpose, the efforts expended in its collection are not in vain if it emphasizes the further recognition of the spirit of co-operative educational advancement in the iron and steel industry."

DISCUSSION BY H. P. HOWLAND*

A year ago at the Wisconsin Steel Company we attempted to increase the efficiency of our gas-fired equipment. Thus far we have installed three pressure burners on our stoves and sixty-six Birkholz-Terbeck burners at our boilers. Our first step in approaching this problem was the installation of checkers in the bottom 25 ft. of the combustion chamber of No. 1 stove. This increased the stove efficiency, but impeded the flow of gas to such an extent that we were unable to use the stove to its full capacity. The next move was the equipping of No. 2 stove with a pressure burner. The air for this burner was supplied through an 18-in. pipe by a No. 9 Sturtevant fan. Having all other air inlets closed we were now able to compel the stove to burn all the gas desired. This type of burner had been expected to effect quite a gas saving by increased stove efficiency. In this we were disappointed.

Saving of Gas Not Effected by Burner Alone

After several tests of stoves equipped with and without this burner, we were forced to conclude that with equipment such as ours, namely, stoves with large checker openings, small total heating surface relative to radiating surface and poorly insulated shells, the burner in itself will not effect any gas saving. The per cent of radiation and stack loss remained practically the same. On these stoves the radiation loss per stove increases practically in the same proportion as the work done by the stove. That is, the total radiation loss on the stove system is practically the same regardless of the number of stoves in use. This may be explained on the ground that the increased pressure in the stove as created by the pressure burner tends to raise the shell temperature. Whether this condition would be true in the case of well insulated shells, we had no way of ascertaining.

In the endeavor to cut down the increased radiation and stack loss, due to forcing the stove by the use of the pressure burner, checkers were installed in the combustion chamber of No. 2 stove. Supported on arches located about 6 ft. above the bottom of the combustion chamber, these checkers extend 57 ft. to the top of the chamber. They are built with 9-in. openings and 4½-in. wall, adding 3800 sq. ft. to the heating surface of the stove. When the pressure burner was now used on this stove, both the stack and radiation loss was found to have been reduced to a marked degree resulting in greatly increasing the stove efficiency. By equipping No. 1 and No. 5 stoves in the same manner, we were able to operate with three stoves. The net result is as follows:

Oct., 1914—Five stoves in use burning 21,000 cu. ft. of gas per min. and heating the blast (36,000 cu. ft. of air per min.) to 1100 deg. Fahr.
Sept., 1915.—Three stoves in operation using 16,000 cu. ft. of gas and delivering the same total blast heat.

How large a quantity of gas one of these burners will burn completely has not been determined. With the gas-main pressure as high as 10 in., we were able to force 9500 cu. ft. of gas per minute through the checker-obstructed combustion chamber and burn it completely. Under these conditions, the pressure in the combustion chamber was 3½ in. and at the chimney valve about ¼ in.

Burner Regulation

This burner lends itself easily to correct regulation. The gas and air mains are equipped with U tubes and regulating valves. The pressures necessary to give complete combustion are ascertained. With the pressure at the required points, the stove tender not only is assured of the required heat, but that the quantity of air supplied is correct. During the past year we have analyzed our stack gases day and night, and find that generally the pressure burner is giving a gas with less than 1 per cent of either carbon monoxide or oxygen which, compared to our former practice, would be called "complete combustion."

The power required to deliver the air to these burners will, of course, depend upon many local conditions. Delivering 9000 cu. ft. of air per minute at 20-in. pressure requiring two No. 9 Sturtevant fans, the power consumed is, approximately, 45 kw. On the basis of a production of 500 tons per day and ½ cent per kilowatt hour, the power cost thus amounts to 1 cent per ton of iron.

Eliminating the Combustion Chamber

You have seen that we accomplish the desired gas saving by using the checkers in the combustion chamber in connection with the pressure burner. Due to their location, these checkers are four times as efficient per square foot of heating surface as the original checkers. We have three stoves equipped with the pressure burner, in which the combustion chamber has been practically eliminated. This method of construction has possibilities which may be of value in designing future stoves.

In order to increase the amount of gas passing through the pressure burners, it is necessary to increase the gas-main pressure. The advisability of this practice is doubtful from the standpoint of efficient furnace operation, since it seriously increases the pressure on top of the furnace. We would propose that instead of using the furnace to create this increased pressure, a booster be located in the gas main. The same result could probably be obtained by using an exhauster on the chimney side of the stove. This latter suggestion offers possibly a simpler operating proposition, more especially in view of the probability that with new stoves of proper design, stack heats may be so low as to interfere with the chimney draft.

Hand Regulation of Burner Desirable

Turning to the problem of boiler burners, we find ourselves inclined to more enthusiasum in favor of some such burner as the Birkholz-Terbeck type than that expressed by the author of the paper. This burner provides an easy, convenient hand regulation of the proper amounts of air and gas for complete combustion, and a mixing chamber for the air and gas before entering the boiler setting. The author has, in our opinion, placed too much emphasis upon variation in boiler house gas main pressure. At most plants there is no great variation in this pressure from hour to hour or day to day. Consequently, if a ready means for hand regulation is

Capt. H. S. Chamberlain, president Roane Iron Company, Chattanooga, Tenn., at Left; Samuel T. Wellman, chairman Wellman-Seaver-Morgan Company, Cleveland, at Right

*Wisconsin Steel Company, South Chicago.

provided and stack gas regularly analyzed there is no reason why reasonably high efficiencies cannot be attained by boiler house operatives.

Boiler Plant Efficiency with Burners

Mr. Diehl places the average efficiency of the furnace boiler plant using the "common burner" at "not over 50 per cent and frequently much lower." We had an excellent opportunity to test nine of our boilers equipped with thirty-six Birkholz-Terbeck burners. Only one furnace being in operation, we carefully measured the gas to the stoves and boiler house, and accurately figured the gas produced by the furnace thus checking our gas input. The feed water and gas was measured for a period of 8 hr. The burners were not touched by any one—in other words—it was a regular operating condition. The result was 68 per cent efficiency. We believe this represents a big improvement over our practice on these same boilers equipped with the common burner.

We would conclude as follows: For use on stoves we believe the pressure burner to be preferable. Regarding boiler burners, first, the point of automatic regulation, as emphasized by Mr. Diehl, does not seem to us to be vitally essential; second, it should be admitted by all that a big step in advance has been taken in equipping a boiler house with burners capable of easy hand regulation in the place of the so-called "common burner."

DISCUSSION BY A. E. MACCOUN*

With the old type of Spearman burner used on the stove test which I outlined in my paper on "Blast Furnace Advancement," before the Institute in May, 1915, an average stove efficiency of 61 per cent was shown, but I pointed out in this paper that the gas in the combustion chamber burned progressively in vertical layers, that the samples above the burner always showed poorer combustion than at the burner level, and that combustion was not complete until the gases had passed out of the combustion chamber into the dome of the stove. By burner refinements, as described by Mr. Diehl, these conditions were greatly improved, and various long tests made on this same stove under the same operating conditions showed an increase in stove efficiency, the average of these tests showing an efficiency of 71 per cent. This improvement was all due to better mixing of gas at the burner and the use of a burner design that eliminated the burning of gas explosively and the throwing out of flame around the burner.

Burner Efficiency with Reference to Gas Mixing

There are three principal methods of mixing gas used by the various burners described; first, the velocity mixing type; second, the vane mixing type; third, the type which mixes by impinging air and gas streams into each other.

Efficient gas burners can be constructed by the use of all of these principles, and as Mr. Diehl has shown, there is no type that has been developed at the present time that we can safely say is the most efficient burner. We can only decide which type of burner is the most efficient after thorough and reliable tests, and at the present time the various types of gas burners have not been tried out long enough in practice and sufficient detailed tests have not been made to arrive at any such conclusion.

Replying informally to Mr. Diehl's paper, K. Huessener gave it as his opinion that the regulation of the chimney draft for varying gas pressure was a neglected essential to correct combustion and high burner efficiencies.

The Development of Commercial Alloy Steels

BY EDGAR D. ROGERS

EDGAR D. ROGERS

General sales manager, United Steel Company, Canton, Ohio.

THIS subject covers such a wide scope that it seems advisable to limit this paper to a more or less historical and practical viewpoint regarding the development and use commercially of alloy steels, rather than to attempt a thesis on the technology of the subject, except in a most superficial way. No attempt has been made to cover the field of strictly crucible steels.

The oldest alloy steels of which we can find record are an ingot of prehistoric times, analyzing 1.20 per cent carbon, 1.60 per cent silicon, unearthed near Nancy, and a tool containing a small percentage of nickel, removed in 1837 from the Cheops Pyramid. Also the Damascus steel of Toledo contained tungsten, nickel and manganese. There is no evidence that these steels were intentionally alloyed, but were the result, probably, of a combination of different element-bearing ores. During the eighteenth century great advances were made in metallurgy, although the opinions on the subject were vague. The effects of phosphorus, sulphur, bismuth, tin, antimony and arsenic in iron were known about 1740.

It was not, however, until the first half of the nineteenth century, and then only after ordinary carbon steel composition had been determined by Reaumur, that the first intentional experiments to alloy metals with iron were undertaken. In 1812 Hassenfratz, under orders from Napoleon, completed his work on the effects of cobalt on iron. The effects of titanium, chromium and tungsten were also known about this time.

SILICON AND MANGANESE

Knowledge of silicon and manganese as alloys was limited up to 1880, although Gautier in 1876 had made observations regarding the hardening properties of manganese. R. H. Hadfield in the year 1880 began probably the first thorough research in the metallurgy of steel regarding silicon and manganese. As a result he published works of vital importance for the development of steel with these elements. Hadfield justly designates the year 1888 as the beginning of a thorough knowledge of alloy steels, when quite a number of such steels were produced in large tonnages and the use of silicon and manganese for the improvement of the physical and magnetic qualities was made practical.

CHROMIUM AND NICKEL STEELS

The founder of the chromium steel industry in America was Julius Baur of New York, who, after receiving letters patent for the manufacture of chrome steel, formed a company in 1869 which soon marketed its product with success. In Europe chrome steels were first produced by Holtzer & Co., Unieux, France. In 1870 they manufactured chrome steel armor-piercing shells and armor plate containing about 2 per cent chrome. Soon thereafter Hadfield began the manufacture of chrome steel in England, and in 1882 furnished chrome steel shells to the English Government which penetrated 8-in. wrought iron plates.

The development from this time on was quite rapid and chrome steel was introduced largely for safe work, jail work and other lines somewhat related to its original uses. The modern manufacture of this steel has broadened it beyond these uses and a large tonnage is now annually used by the ball and roller bearing industry. It is also used extensively in tool manufacturing lines and for other purposes where intense hardness is essential.

*Carnegie Steel Company, Braddock, Pa.

From 1822, when Stodart and Faraday at Sheffield published their experiments on the alloying of nickel and iron, up to 1885, when a pure ferronickel was brought out, nickel steel, on account of its expense, was not developed to any great extent. While during this period Wolf, Fairbairn, Therber, Bessemer, and others, carried on extensive and valuable investigations, contributing to the development of this steel, it nevertheless remained for James Riley, then of Glasgow, to demonstrate by practical tests the advantages of alloying nickel with steel. Mr. Riley's paper on this subject, read before the Iron and Steel Institute of Great Britain in 1889, gave an impetus to the introduction of nickel steel in a commercial way.

The advantages of nickel steel in ordnance led to its use in the manufacture of guns of heavy caliber. The fact that the propeller shafts of the gigantic double-screw express steamer Deutschland, launched in 1889, were made of nickel steel is evidence of the remarkable progress made in the manufacture of this steel and the recognized advantages in its use.

Nickel steel is now used extensively in automobile construction for parts such as frames, gears, shafts, and its utility in fields of structural fabrication, engine building, ship building, and many kindred lines too numerous to mention, is established and increasing.

VANADIUM IN STEEL

In 1803 Del Rio, professor of mineralogy in the City of Mexico, isolated this element and called it erythronium. However, it was not until 1830 that Sefstrom, a Swedish investigator, succeeded in attributing the superior properties of some of their soft irons to this wonderful element, and gave it its present name.

The manner of the use of vanadium and its effect became known no sooner than 1900 through Arnold, who demonstrated a method of using it in a commercial way. Further investigations as to the action of vanadium in steel have been carried on by Nicolardot, Guillet, Putz, and others. With its marked affinity for numerous elements it was found in minute contents combined with the various minerals universally.

Owing to its enormous cost, which in 1895 exceeded $10,000 per lb., very little was done with it as a steel alloy, but a vast deposit was unearthed in South America in 1905 and its cost was thus soon brought within reach of the commercial consumer.

Its property as a scavenger in cleansing steel of its impurities other than phosphorus and sulphur, and the dynamic qualities, together with the superior static results obtained when used in conjunction with chrome, created a demand for this alloy which has been remarkable. The Swedish irons used as a base for high-grade crucible steels owe their virtues to this element. One of the first extensive uses synthetically, however, was in conjunction with high speed steels whose cutting properties were trebled and even quadrupled thereby.

The automobile, locomotive and high speed engines, with their demands for anti-fatigue material, opened a wide field for this product. It was this demand that caused the entry of the open-hearth and electric furnaces into the manufacture of this alloy steel.

About 1907 chrome-vanadium steel was first successfully made in the open-hearth furnace in commercial quantities. The consumption of vanadium as an alloy has steadily grown so that to-day it is used in combination with practically all other alloys, and in crucible, electric and open-hearth practice.

RECENT DEVELOPMENTS

The use of alloys in the manufacture of steel was effected in a commercial way about 1880. The demands of a steel to meet the use of more powerful explosives was the first influence toward the use of alloys and resulted in the introduction of nickel and chromium in steel for ordnance work. In their infancy these steels were made and alloyed in the crucible, and it was from the crucible mills with their ultra-expensive practice that the consumer obtained his supply. Later the demand increased so tremendously that the open-hearth and electric furnaces were drafted into service, the former turning out an excellent product at a very much decreased cost owing to the tonnage involved, and the latter rivaling the crucible for purity and with its costs also decreased as against the crucible practice. This was due to the charge of tons in the open-hearth and electric as against the crucible's charge in pounds.

During the past decade wonderful strides have been made in the development of alloy steels of high physical properties. Such developments were brought about largely by the severe and exacting requirements of automobile manufacturers, as with the introduction of motor vehicles it became necessary to economize in space and weight, and to meet these requirements metallurgists turned their attention to the development of steels of greater efficiency. This resulted in the adoption of practically standard analyses, by which small percentages of the standard alloying elements, vanadium, chromium, nickel, tungsten, etc., introduced into the metal increased its strength, toughness, hardness and other physical properties sufficiently to meet the exacting conditions. In addition to the alloy steels containing the above mentioned elements, another class was developed by adding abnormal quantities of the essential impurities, silicon, manganese, or both, either with or without the aforesaid alloying elements. The production of satisfactory manganese, silicon and silico-manganese steels is now commercial.

MACHINABILITY OF ALLOY STEELS

Some consumers specify alloy steels which must be made to analysis, heat treated to certain required physical results, and then either cold drawn or turned and polished, so that the consumer has only to use the steel as furnished by the steel manufacturer in its finished form. This demands of the steel maker not only heat-treating facilities but equipment for producing steel with the highest possible finish.

The problem which is now confronting the steel maker more and more is the machinability of steels capable of possessing high physical properties. Marvelous developments in tool steels, due to the improvement of the present-day high speed steels, has caused a proportionate increase in the efficiency of machine tools which means a "speeded up" production inconceivable ten years ago. I believe that the efficiency in improving machinable steels has not kept pace with the improvements in tool steels and machine tools. This is not entirely to be blamed upon the steel maker, as much steel is furnished in a green state, or the operations performed upon the steel before machining being thermal in nature destroy its production efficiency unless this structure is returned to its proper status. There is a large field for investigation as to the various mill operations to obtain a commercial practice which will deliver steel to the consumer in a uniformly machinable condition.

A few years ago, and even to date, a steel which was difficult to machine was "annealed." The peculiar characteristics of the steel were not investigated, but the steel was treated in a more or less superficial way and heated "somewhere in the neighborhood of 1500 deg. Fahr. and cooled in a slow heat conducting medium," which sufficed to obtain more or less uncertain results for the customer. Inasmuch as we are living in a day of special steels and each steel is indeed a deep study in itself, the problem of machinability becomes not that of a mere annealing (which in some cases is sufficient, however) but a scientific research of the metal through its many operations from ingot to bar. Casting, breaking down, rolling and principally finishing temperatures, all must be looked into with utmost care. These details must be not only ascertained but duplicated day in and day out in order to reach the ideal condition. Thus when each grade of steel is intentionally, and not more or less accidentally, made a consistent machining proposition, will the production which is sought be attained.

THE SPECIFICATIONS

The question of chemical and physical specifications is an important one to the steel maker. It has been the habit of consumers when buying their materials to specify both chemical and physical properties, and in a good many instances properties that are conflicting and inconsistent. It has been our experience, and no doubt

that of all the other makers of steel, to receive orders on which certain chemical limits that are commercially possible are outlined, and then physical results demanded that are absolutely impossible with the prescribed analysis.

In some cases the ductility factors, elongation and reduction are specified at percentages that cannot be met with the high elastic limit required. In others the hardness (placed either at a maximum to obtain machining qualities, or at a minimum to assure the elastic limit being up to specifications) is entirely inconsistent with the tensile strength and elastic limit. These discrepancies are in a good measure due to the steel makers themselves because only a few years ago the data at hand on alloy steels were obtained through tests in which the type of steel was the only variable, little consideration being given to section when recommending a steel for a prescribed purpose.

A standard test piece which has been heat treated after machining, as we all know, will show percentages of elongation and reduction which cannot be obtained with a test piece machined from a heat-treated part of greater section. Also a treatment which will produce certain properties upon a test piece treated after machining will not suffice for the heavier section. Because of the inconsistency of imposing physical specifications based on a standard test specimen heat treated, as against a specimen cut from a larger section after heat treatment, steel manufacturers have often found difficulty in meeting the requirements demanded.

Physical specifications should be drawn up in accordance with the results which should be obtained from tests taken from the full section in question. Data are often given out by steel manufacturers as to physical properties of steel without specifying the section from which the tests are made, which is thereby misleading.

PROPER ELASTIC LIMIT

Again, concerns have been impressed with the virtues of some type of alloy steel by reason of its exceptionally high physical properties, and assume, for instance, that a steel which is stated to show 200,000 lb. per sq. in. elastic limit must necessarily be better than one which shows only 150,000 lb., ignoring entirely the purpose for which the steel is to be used. In reality the lower elastic with greater ductility may, for a particular purpose, serve to better advantage than the higher elastic and lower ductility, both results, however, being obtained from the same steel by different thermal manipulation.

The various types of alloy steels each have distinct properties for a constant elastic limit. The elastic limit is the working feature in all parts because after determining the stresses and by adding a factor of safety there is obtained a gross stress which must be resisted, and this resistance must in all cases be exceeded by the elastic limit. The type of steel then to be selected should be determined by the nature of the stresses and not the amount, for it is possible to obtain equal elastic limits in several of the alloy steels that are made today; for instance, where an alternating stress will cause a chrome-nickel steel to fail a chrome-vanadium steel will serve satisfactorily, even though it is treated to show no greater strength. This is due to its superior dynamic properties.

The consumer should, when specifying steel, arrive at the grade through the nature of the stresses, the elastic limit by the amount of the same, and be content with the tensile, reduction, hardness, etc., which that particular type of steel must necessarily possess with a certain elastic limit.

PROSPECTIVE

The manufacture of alloy steel tube stock has received great impetus in this country since the war began. In fact, many consumers in this country have learned that a high-grade product of alloy steels can be obtained from the American steel makers. Steels which were formerly purchased abroad are now being produced by American manufacturers with satisfactory results. Therefore, the American steel maker, as well as the maker of finished articles heretofore imported, can hope to retain this trade, it having been fully demonstrated that American steels are equal in quality to the foreign steels.

The railroads have been far less active in the adoption of alloy steels than the automobile manufacturers, though during the past few years there has been on their part a greater realization of the merits of alloy steels effecting greater safety when operating at high speeds. The saving in weight in construction is a factor that the railroads cannot well overlook, as during the past few years the trend has been to tremendously increase the size of locomotives. This cannot be done without a decided increase in weight unless an alloy steel is used.

The first obstacle in securing a more universal acceptance of alloy steel by the railroads has been the lack of preparedness on their part to properly heat treat. I wish to make myself clear on this point in particular, namely, that an alloy steel without heat treatment is but little better than a carbon steel, and in some cases more dangerous. Sound business principles should prompt the user to heat treat in order to obtain the maximum efficiency for which the consumer pays the additional cost for alloy above carbon steel. Proper heat treatment will in many alloy steels approximately double the static strength and will at the same time produce a higher degree of ductility. Railroad shops as a rule are woefully lacking in proper equipment for heat treatment, and until they provide furnaces of close and uniform operation and control, dependable heat measuring apparatus, suitable quenching facilities and mechanical methods of handling the material, it will be impossible for them to realize to the fullest extent the degree of superiority of the alloy steels over the carbon steels.

The steel maker can furnish the axles, side rods, and other forgings, heat treated and rough turned, finished or ready for finishing, but he can only furnish such parts which are not in the course of manufacture subjected afterward to any hot work, and parts where no greater hardness than is consistent with good machining is essential. A proper heat-treating equipment would be of great service to the railroads also in the rebuilding or repairing their present rolling stock with durable alloy steels.

FUTURE OF ALLOY STEELS

I predict that the next few years will show a greatly increased demand for alloy steels from the manufacturers of railroad equipment, machine tools, engines, mining machinery, farm tractors, aeroplanes, etc. Alloy steels will also occupy a larger field in marine construction, particularly in submarine work.

The aeroplane manufacturers are already calling for the highest grade of electric furnace alloy steels. If we review the wonderful development of aeroplanes in the last few years we can readily get a better idea of the greater possibilities in the future.

The field for the development of the tractor engine offers one of the attractive American manufacturing possibilities. The successful development of tractor engines in a large measure will depend on the increased use of alloy steels so that the tractor may be lighter in weight and stronger in construction.

Many other manufacturers have up to this time overlooked the great possibilities in the use of alloy steels in their products. There is a wide field for development.

GENERAL CONCLUSIONS

The experience of alloy steel makers during the past seven years shows a steadily decreasing cost of production and a decreasing selling price due to many changes in manufacturing methods. Some mills which are now specializing in alloy steels have developed as the result of their experience methods of manufacture which are quite dissimilar in many phases to the manufacture of common steels. The waste product has been greatly reduced, this having been accomplished by the reclaiming of material which was formerly rejected. Heretofore the practice was to discard a very large percentage of the heat which resulted in high cost of production. Economical methods put into effect resulted in a higher quality of steel and a better practice. While chipping, grinding and reclamation of steel in other ways entail

a higher cost per ton for the making of the steel, they have resulted in ultimate decreased cost and cleaner billets, producing not only a greater yield of bars but a finished material free from defects and imperfections. This is beneficial not only to the consumer but also to the manufacturer, who, by conscientiously cleaning his stock, is assured that the material will remain sold and give satisfaction.

Citing my company for example, rejections by the trade during the past seven years have declined very materially; that is, from 5 to 10 per cent seven years ago until during the past few years average rejections have been less than one-half of 1 per cent.

Lower costs are due also to decrease in cost of some of the alloys, as, for instance, ferrovanadium, and to lower cost in heat treating, because of the greater amount being treated, together with improved design in furnaces to facilitate handling the stock. Lower selling prices will generally result in the further expansion of tonnage.

THE ELECTRIC FURNACE

The perfection of the electric furnace for steel melting has enabled the manufacturer to duplicate by this method many steels which were formerly made in the crucible, and at a reduced cost. There is a large opportunity for introduction of such steels for use where the excessive cost of machining necessitates an absolute minimum of rejection, and which steels cannot be made successfully in the open-hearth furnace. This is especially applicable to parts where under rigid inspection minute defects cause rejections.

The advancement made in the manufacture of alloy steels in recent years is a tribute to the steel makers and speaks for the progress, the increased efficiency and years of hard work on the part of the steel manufacturer necessary to accomplish this result. From one point of view this remarkable efficiency of practice is a greater achievement than some of the metallurgical successes in the field of alloy steels. It is a homely story of human effort which is only fully appreciated by the steel manufacturer.

Discussion

George L. Norris, American Vanadium Company, discussing the paper extemporaneously, recalled how in ancient times the Damascus blade was the standard for all steel, and how for a long period the early development of special steels was inspired in the interest of perfection of war materials. In the present day, the improvement of alloy steel has had its greatest impetus in the demands of automobile construction. Investigations of the last two years have also shown marked advantage in the use of vanadium in rail steel. Locomotive forgings also present a large field for its use, but it was pointed out that in locomotive construction, where weight is required, the alloy steel loses much of its particular function and heat treated carbon steels are the less costly material. In automobile construction where maximum strength with a minimum weight and cross-section are desired, the substitution of alloy steel for carbon steel is the logical necessity.

Heat Treatment in Automatic Electric Furnaces

BY THADDEUS F. BAILY

THADDEUS F. RAILY

President Electric Furnace Company of America, Alliance, Ohio.

SINCE the earliest time of which we have record of the use of steel, heat treatment for the purpose of increasing its physical properties has been carried on with the materials for war purposes; but until the advent of motor-car production in commercial quantities, heat-treatment of steel in commercial work was little practised excepting in the treatment of tools.

The strains developed in motor-car operation, however, demanded material of greater strength and resilience than that of common steels, and new alloy steels showing remarkable physical properties were rapidly produced in commercial quantities. It soon developed that even these new steels must be heat treated in a proper way as determined by their composition, in order to get reliable results in their use. It was at this time that heat treatment of steels in large quantities became acknowledged as an essential operation in the manufacture of all steel parts subject to severe strain. It is thus to be noted that although the advantages of heat treament were known from the earliest time, this knowledge was not put into extensive commercial practice until the success of a great industry depended upon the application of this knowledge.

THE PROBLEM OF HEAT TREATMENT

The problem that immediately confronted the users of heat-treated steel was the lack of uniformity shown in its physical properties, and this for any given steel was immediately traced to the imperfections of the means employed, as heat treatment at first was done in some crude form of combustion furnace, either oil, gas or coal fired. Coupled with the imperfections of the heat-treating furnace itself was the inadequate means for quenching the material after heating for the purpose of hardening, and it soon became known that for a given steel the quenching temperature, the time in the quench, the quenching liquid and its temperature were all factors of importance affecting the physical properties of the steel under treatment. Another, and one of the most uncontrollable variables, was the human element, to which all the other variables were more or less inseparably tied.

The problem of heat treatment, then, becomes one where, if results possible of attainment with any particular steel are to be realized and engineering calculations based on these figures, the treatment must be carried on in such equipments and by such methods that the chance of any variation in the essential features of the treatment must be reduced so as to preclude the possibility of the material passing through the heat-treating equipment without receiving the treatment intended.

It has been possible to control automatically to some extent the temperature of oil or gas furnaces, but no device has yet been designed which has proved itself dependable. Even assuming perfect control of temperature, there is yet required means for automatically removing the material from such controlled furnace, quenching it quickly in a quenching medium of constant temperature for a definite length of time, removing it from the bath and charging it into the second or drawing furnace, which must also be of constant temperature. Even assuming that the temperature of the furnaces can be kept constant by some automatic fuel-control means, and that suitable means may be developed for handling the material through the various operations just cited, there is in this general scheme the fatal weakness that the furnace temperature and the temperature of the material under treatment may vary greatly and the whole scheme from a practical standpoint break down on this feature.

AUTOMATIC CONTROL OF HEAT AND MATERIAL

With the development of electric furnaces for heat treating, it became apparent that the temperature of such a furnace could be readily maintained within a few

degrees of the designated temperature, whether standing idle or running at any predetermined capacity. This type of furnace, then, so far as temperature control was concerned, was all that could be desired; but the human element involved in the operations of drawing the charge when heated, quenching and recharging still remained, and in response to a demand for a heat-treating equipment of the automatic type where the human element would consist solely in the placing of the material on the charging platform of the first furnace—all subsequent operations being done automatically in accordance with the predetermined adjustment—the equipment now to be described was developed. One of such equipments has operated continuously over periods of more than 3000 hr., in which time more than 8000 tons of steel were treated with a temperature variation of less than 10 deg. Fahr. in the metal; a uniformity of results in the physical properties of the material treated were obtained which indicate that the small variations noted in the tests one with another were due solely to the slight variations in the composition of the steel.

THE EQUIPMENT AND ITS OPERATION

A typical equipment embracing all the features required to perform automatically the essential operations in heat treating, consists of an electric furnace of the continuous type in which the material under treatment is moved through the furnace on cast beams of suitable shape and composition by means of hydraulic pushers; a transfer and quenching device hydraulically operated is adapted to reach into the furnace immediately after the opening of the doors; then a charge of heated material is pushed on to this transfer platform by the pusher at the opposite end of the furnace. When this material has reached a central position on the transfer platform it is withdrawn from the furnace and plunged into the quenching bath. The downward movement of the transfer opens the valve on the quenching medium supply line, which supply is maintained under a constant head and temperature.

The transfer platform with its material remains in the quench, and the cold quenching medium is allowed to flow unrestricted until a time element device actuates the hydraulic valve on the lift cylinder of the transfer, whereupon the transfer platform with the material is raised out of the quench and placed on the charging platform of the second or drawing furnace, where it remains at rest until moved into the second furnace by the pusher on that furnace. Simultaneously with the movement of the material into the second furnace, the heated material is pushed out of the discharge end.

The important element in the operation of the entire equipment is the temperature measuring devices adapted to take the temperature of the material under treatment itself, not the furnace temperature, and when the material has reached the designated temperature these special pyrometers actuate the interlocked electrically operated hydraulic valves on the valve pulpit controlling the cylinders performing the various motions of the equipment.

It will thus be seen that the material cannot be removed from the first furnace until it has reached the prescribed temperature, at which time it is quickly removed and quenched for a definite period in a liquid of constant temperature, after which it is put into the drawing furnace and subsequently withdrawn upon reaching the designated temperature for the drawing operation. When the material under treatment is delivered at the discharge end of the second furnace it can have had no other treatment than that for which the equipment is adjusted.

Such equipments as the one just described produce materials whose physical properties are increased to the full extent of the theoretical possibilities of heat treatment. And this is accomplished with a marked reduction in labor and usually at a lower net cost for treatment than by hand-operated fuel-fired furnaces.

Discussion

As presented by Mr. Baily the paper was made exceedingly effective through the showing of a film portraying the furnace described in actual operation. S. T. Wellman, in discussing the paper, suggested with emphasis that electrical operation of the mechanism should be substituted for hydraulic.

MR. WELLMAN CONGRATULATES MR. BAILY

Discussing the furnace further, Mr. Wellman said: "In the heat treatment of steel, especially alloy steels, it is of the greatest importance that the treatment should be exactly alike in every piece of steel. If occasionally a piece goes through without proper treatment, it is, of course, an occasion of weakness in whatever machine it is used, and if failure follows, the damage to the reputation of the maker of the steel cannot be measured in dollars and cents. Any steel maker can make some steel of the highest quality. No steel maker can make it always perfect, but the one that comes the nearest to the 100 per cent mark is the one that gets the best of the trade.

"What the steel maker wants and needs is apparatus that is fool proof. Mr. Baily's scheme for heat treating, if properly designed and built, should come very near this much desired end. If this invention of Mr. Baily's could be successfully applied to heating furnaces or soaking pits for hot steel ingots, it would have a wide field to work in. There is room for great improvement over existing practice. The present furnaces have always seemed to me very crude and an immense amount of heat is lost. I believe that an electrical furnace somewhat on Mr. Baily's design can be made that will beat the ordinary gas furnace in cost of operation."

Commenting upon Mr. Wellman's designation of himself as a "has-been," Judge Gary said: "Some of the most prominent has-beens are some of our most effective and necessary izzers. Mr. Wellman cannot relegate himself to the has-beens. Behold him reading without his glasses."

DISCUSSION BY PROF. J. W. RICHARDS

Mr. Baily has opened up a method with a wide range of possible usefulness. The automatic heat treatment, eliminating the personal factor of the workman, is a great step in advance in the heat treatment of steel. With proper design and heat insulation, electric furnaces of the Baily type should be capable of putting into the articles to be treated 50 per cent of the heating energy of the current.

At places where electric power is expensive, it should be practical to arrange the furnace to burn coal, gas or oil for preliminary heating to within 100 or 200 deg. of the quenching temperature, and then use the electric heating only for completing the heating and adjusting the final quenching temperature. Such a combined fuel and electric furnace might work cheaper in many localities than an all-electric furnace. In fact, if gas or oil is available, it would seem quite simple to introduce some fuel heating in Mr. Baily's electric furnace itself, and thus lower the power consumption where current was expensive.

There seems no doubt that some such device would improve rolling practice, by discharging ingots from the furnace always at the proper temperature. The electric furnace could then act as an electrically-controlled soaking pit, which would receive hot ingots and discharge them only at the properly adjusted temperature. A furnace of the pusher type, with electrically-controlled discharging device, would achieve this end. The heating might be all-electric, or part electric and part gas, or all-gas.

CONCLUSION OF THE DISCUSSION

Referring to Mr. Richards' opinion that 50 per cent of the heat energy of the current might be transmitted to the steel, Mr. Baily stated that their furnaces under observation had shown a thermal efficiency of 92½ per cent. In reply to a question by Dr. A. S. Cushman as to the arrangement of pyrometers for the accurate determination of the temperature, Mr. Baily advised that the pyrometer was located within ½ in. of the metal at the point of discharge, and to Dr. Cushman's statement that surface temperatures of sizable bodies

of steel were an inaccurate measure of interior temperatures and that assurance of the thorough soaking of an ingot might therefore be lacking, Mr. Baily returned that it was their practice to allow such a liberal period for heating that there could remain no doubt of the uniform temperature throughout the piece.

Control of Piping and Segregation in Ingots

BY DR. HENRY M. HOWE

DR. HENRY M. HOWE

Professor of metallurgy, Columbia University, New York City.

THIS paper explains the more important elementary principles by means of which piping and segregation in steel ingots may be lessened. Many of these principles I have verified by means of direct unpublished experiments. Yet the subject is so complex that I may have overlooked others. Hence my inferences are provisional, and subject to control by direct tests.

PIPING

The reason why the axial cavity or pipe forms is that during the latter part of the solidification the middle parts of the ingot are contracting faster than the outer parts. The relative rates of contraction of the outer and inner parts therefore govern the whole matter. These rates of contraction represent roughly the corresponding rates of cooling, and it is by studying these rates of cooling that we can best understand the matter.

When a mass of molten steel is poured into a cold metallic mold, its skin begins cooling very rapidly by the escape of its heat into the mold walls, whereas the cooling of the interior is much slower, because the heat that escapes thence must pass chiefly through the still hot outer walls of the ingot. As soon as a continuous outer crust has formed on the top as well as the sides, two parts may be recognized, the outer and *solid parts*, containing what we may call a *cave*, still filled with molten steel.

During the early part of the solidification, because the outer parts are cooling faster than the molten interior, the dimensions which they tend to give the cave are smaller than the volume of the metal which that cave has to contain, quite as when a hot tire is shrunk on a wheel the dimensions which it tends to give the space within it are less than those of the wheel. Because the molten within the cave, like the wheel within the tire, is incompressible, it resists the natural contraction of its walls and in effect stretches them in the sense in which the wheel stretches the tire, preventing it at every degree of temperature in the cooling from contracting to the natural dimensions which it would have reached if unopposed.

But this cooling of the outer parts cannot continue indefinitely to be faster than that of the interior, because, both starting at the same temperature, say 1500 deg., and cooling to the same temperature, say 0 deg. C, have the same temperature range to pass through, and toward the end of their cooling, when the center has sunk to say 100 deg., the other parts are but little cooler than the central ones. Hence because the outer parts cool faster than the inner at first, they must needs cool less rapidly than the inner parts later on, and at some moment in between the rate of cooling of the outer and of the central parts must be identical. We may call this the *neutral moment*, and the periods which precede and follow it the pre-neutral and the post-neutral ones, respectively. During the whole of the preneutral period, because the contraction of the outer parts tends to be more rapid than that of the central ones, the outer parts are being stretched by the resistance of the slower cooling central parts, but this rate of stretch decreases continuously till, at the neutral moment, it becomes zero. At this moment, as at every preceding one, the dimensions of the cave exactly fit those of the molten, because the molten in resisting the pressure of the walls of the cave has stretched them out to its own volume.

But the excess of contraction of the interior of the ingot over that of the shell from the neutral moment on gives rise to a void which at every instant is equal to that excess. Where will this void lie?

TOP OF THE PIPE IS THE TOP OF THE MOLTEN AT NEUTRAL MOMENT

If Fig. 1 represents a cube of molten steel in an iron mold losing heat equally in every direction, then the concentric squares F, F', F'', etc., are *isotherms*. One specific isotherm concerns us greatly, that of the freezing point, assuming for simplicity that the metal has a definite freezing point instead of a freezing range. This we may call the *tectotherm*. During the preneutral period the tectotherm coincides at every instant with the top, bottom, and sides of the cave, which are also those of the molten.

Let cube F'' of Fig. 1 represent the tectotherm and hence the outline of the cave at the neutral moment. Clearly the deficit of contraction of the interior compared with the exterior, a deficit which begins with the post-neutral period, or in other words the shortage of the molten compared with the volume of the cave, will henceforth prevent the top of the molten from reaching quite to the top of the cave, with the result that, a few moments later, a thin flat void will exist, such as is shown just below the top of cube F''. This void, which is the beginning of the pipe, will persist.* In order to show it I have to give it a visible thickness, such as it will reach shortly after the post-neutral period begins. But its very incipiency occurs at the neutral moment, and by parity of reasoning, its incipient width, that is its width at its very top, is that of the top of the tectotherm at the neutral moment, which is also that of the molten then, Q. E. D.†

THE PIPE'S WIDTH AND THE WIDTH OF THE TOP

At this moment the width of the top and of the bottom of the void are practically the same. As freezing proceeds, the continuing deficit of contraction of the interior compared with the exterior leads to a continuous increase in the volume of the void. Its top will remain that with which it started, and its bottom will be the surface of the molten at each successive instant. To trace the position of this bottom accurately would carry us too far, but to fix our ideas we may imagine that the increase of volume of the void just keeps pace with the thickening of the walls, so that when, in the course of solidification, the walls and bottom of the cave have become those of cube F'', the top of the molten will have sunk so as to coincide with the top of F'', and that the same holds true of cube F''. The width of the pipe at each level will be the width of the cave

*The slight narrowing, due to the linear contraction of the solid metal from the freezing point down, need not here be considered.

†That the inner part of the walls should be contracting more rapidly than the outer part at the relatively early stage in the solidification at which the pipe begins forming may surprise us. Perhaps an easier way of understanding this is to conceive the thermal gradient as extremely steep at the beginning of solidification, and as nearly flat when cooling is nearly complete, and thence to infer that its steepness decreases continuously from the beginning, or at least from very early in the solidification to the end of cooling. But a flattening of the thermal gradient means that the outer parts are cooling more slowly than the inner.

A more accurate but more complex picture is that, because they are integrally united, the various concentric layers which make up the already solid walls, are striving against each other because of their different rates of cooling. This struggle will go on with varying resultants, but with the general result

at that level at the moment when the surface of the molten is at that level, and hence under our present assumptions, will at stages F^{III} and F^{IV} coincide with the width of cubes F^{III} and F^{IV}. Hence after solidification is complete, the outline of the pipe will be represented by th lines *bcde*, $b^1c^1d^1e$, an inverted cone with its apex at the center of gravity of the whole, and its base where the top of the tectotherm was at the neutral moment.

TO RAISE THE ISOTHERMS RAISES THE PIPE

Though the foregoing assumptions are not accurate, they suffice to show us that the position of the pipe depends on the successive positions of the isotherms, of which the tectotherm is but one. Hence the inference that to raise the isotherms raises the pipe. In particular to raise the position which the tectotherm occupies at the end of solidification is to raise the bottom of the pipe, and thus to reduce the discard needed for removing the pipe. But to raise the isotherms is only a philosophical way of saying that the cooling of the top should be made to lag as far as possible behind that of the lower parts, or that the pipe forms in the slowest cooling part.

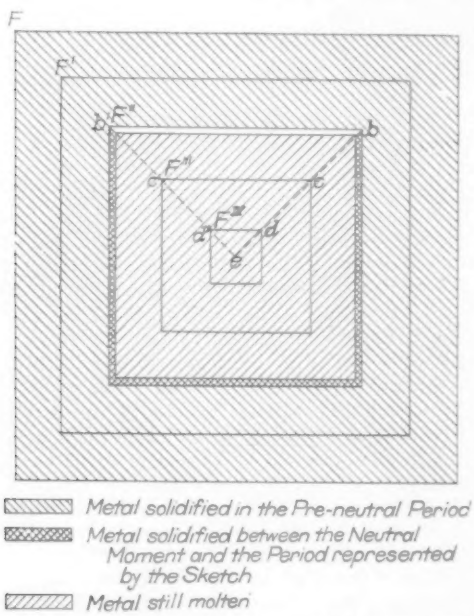


Fig. 1—Vertical Section Through a Solidifying Steel Cube. The top of the pipe b^1b corresponds to the upper surface of the molten at the neutral moment. With uniform heat escape, and under certain ideal conditions, the bottom of the pipe should be at the center of gravity, but for sagging

This is shown as regards the vertical position of the pipe by castings *A* and *B*, which really form parts of one and the same casting, poured simultaneously from the same ladle, save that *A* naturally filled before *B*. The broad ends or bases of these two pyramids cooled much more slowly than their apices, not only because they were thicker, but also because they kept each other warm, whereas the cooling of the apices was hastened by contact with the cold iron walls of the mold, especially because these walls thickened from base to apex of each pyramid. This slower cooling of the base than of the apex has set each pipe near the base, of its pyramid, above the center of gravity of *A* and reaching to below that of *B*.

That the pipe forms in the slowest cooling part not only vertically but also horizontally is shown by casting *C*, Fig. 4, cast in a mold of which the right-hand side was of iron and the left-hand one of clay. This, because it accepts heat so slowly from the metal, in effect moves the isotherms to the left, and with them the pipe.

GRAVITY RAISES THE PIPE

In the ideal case of Fig. 1 the pipe stretches up from the center of gravity of the ingot. This same principle explains in part why the pipe is nearer the base or large end in casting *A* than in casting *B*. But this difference is exaggerated by another condition. At every stage during the solidification, the walls of the cave, being barely at the freezing point, are barely solid and therefore sag down by gravity, or to look at it from the opposite point of view, the void or pipe swims slowly upward by gravity through the viscous mass. In this sagging of the metal and lifting of the pipe not only the very face of the walls but also the metal for a considerable distance back from them take part. This sagging aids powerfully in raising the position of the lower end of the pipe, and thus in decreasing the needed discard. Clearly a retardation of the cooling of the top, however brought about, facilitates this sagging. Beyond this, mere retarding of the solidification as a whole, whether through increase in the cross section of the mass, through the use of poorly conducting clay or dry sand walls or otherwise, increases the time available for this sluggish movement.

PIPE RAISING THROUGH SEGREGATION

We shall see that solidification is accompanied by an enrichment of the upper part of the molten in carbon. This means a lowering of the freezing point there, with the result that the tectotherm ceases to be strictly an isotherm, but corresponds to a lower temperature in the upper than in the lower part of the ingot. This is as if at the moment when the lower part of the tectotherm, the outline of the molten, coincided with the lower part of cube F^{III} of Fig. 1, its upper part coincided with the top of cube F^{II}. Because the carbon content of the upper part of the molten is greater than that of the lower part, the freezing of the upper part is occurring at a temperature lower than that of the lower part, that is along an isotherm nearer the outside of the ingot, and hence nearer the top.

This difference between the tectotherm and the isotherms, coupled with the sagging and swimming just explained, and the habitual open top, explain why even in narrow-topped ingots the pipe, instead of being chiefly below the mid-height of the ingot, is well above it.

INDUCING TOP LAG AND WIDE-TOP CASTING

The influence of a wide top in raising the pipe has already been illustrated by castings *A* and *B*. The conditions are not so unfavorable to narrow-top castings in actual practice, because here the narrow-topped ingot does not in addition have its apex chilled by the contact of the mold and its base warmed by that of a body of hot metal below. But for gravity and for the exposure of the top to warm air instead of to the cold stool, the pipe might be expected to be as much below the center of gravity in a narrow-topped ingot as it is above that of a wide-topped ingot. But in lifting the pipe, gravity moves it exclusively up and away from the center of gravity of a wide-topped ingot, whereas in a narrow-topped one part of this lifting effect of gravity is consumed in bringing the pipe from below up to the center of gravity, and only the residue is available for lifting the pipe above that center. The massing of metal at the top of the wide-topped ingot clearly favors sagging and the resultant raising of the pipe.

Top Heating, which in effect raises the isotherms by retarding the cooling there, may be brought about by means of a coke, gas, or other fire, by electric heating, or by pouring on molten slag. Hadfield's process for preventing the heating agent from carburizing the upper part of the steel by interposing a slag buffer is important. Remarkable results are rumored to have been reached by covering the top of the molten metal with graphite, which should carburize the metal there, lower its freezing point, and thus prolong the period

that the progressively firmer outer parts resist to ever better advantage the tendency of the faster cooling inner parts to drag them inwards. This result in time brings on the neutral moment when the actual inward travel of the inner face of the walls ceases to exceed the shrinkage of the molten caused by the continuous transfer of its particles to those solid walls.

The special properties of iron, such as its marked expansion in cooling through the transformation range, offer themselves as tempting explanations of why the pipe forms, that is why the volume of the cave begins at the neutral moment to exceed that of the molten, thus giving rise to the void or pipe. But this temptation is to be resisted, not so much because this expansion is a wave which passes through from crust to center, and hence explains that exceeding only lamely, as because the pipe forms in the solidification of so many different kinds of substances, which undergo no corresponding transformation after solidification.

during which it remains fluid enough to sag and feed the pipe.

Top Insulation, which raises the isotherms by retarding the escape of heat from the top, may be effected by the use of clay or other non-conducting prolongations of the mold, which may be preheated as in crucible practice, thus adding top heating to top insulation, or by coke, clay, or other coverings, cold or hot. Indeed most of these steps do both. Gathmann's molds, thicker below than above, in a sense cause top insulation, in that they remove less heat from the top than from the bottom.

Open Top.—The usual practice of either covering the upper surface of the ingot with sand or other insulating material or leaving it open to the air, is in effect a form of top insulation, for the escape of heat is less rapid into the sand or air than into the cold iron mold walls.

Top Replenishment, by adding molten steel toward or after finishing the pouring of the ingot proper, both helps directly to fill the pipe and also gives top heating.

Slow Pouring is a very cheap and effective mode of replenishment. Clearly, retarding the pouring raises the isotherms by heating the top while the lower part is losing heat rapidly into the mold walls. Slow pouring is thus in effect a kind of top heating. I have found that by pouring very slowly from a heated ladle I could efface the pipe completely under conditions which otherwise led to a very deep pipe.

Bottom Pouring, for like reasons, tends to deepen the pipe, by adding fresh hot metal to the bottom of the ingot even after most of it has been poured and has started to transmit its heat into the mold walls. It thus lowers the isotherms and with them the pipe.

Sink Heads act through top replenishment, top heating, and in a sense through slow pouring. They feed down as fast and only as fast as the pipe tends to form.

PIPE FILLING CHIEFLY FROM BELOW

The slower contraction of the outer than of the inner parts of the solid walls during the post-neutral period may be prevented or cured forcibly by mechanical compression after many different methods, by compressing the ingot lengthwise in Whitworth's way, with perhaps the maximum pressure requirement; or by driving the ingot as a tapered plug into a tapered hole as in Harmet's way; or by pressing in one of its flat sides in S. T. Williams' way, with perhaps the minimum pressure; and in any one of a dozen other conceivable methods. Except in the case of very large ingots mechanical compression often seems like doing by brute force what could be done by finesse, by planning the thermal conditions. Compression generally has to be postponed till after the solidification has progressed far, when it has to overcome very great resistance from the already solid walls of the ingot.

PIPE FILLING BY MEANS OF BLOWHOLES

The commonest method of all is to limit carefully the killing of the molten steel so that it will evolve gas rather late during solidification, and therefore cause blowholes which are deep enough not to oxidize. In effect these puff up the inner parts of the already solid walls, and thus cancel their tendency to cause a pipe by contracting more slowly than the outer parts. This effect can be traced in Fig. 4, in which the abundance of the blowholes has reduced the pipe *P*, to its relatively small size. Not only the white vermicular spaces at the right but also most of the light gray ones there are blowholes, whereas the darker gray ones on the left are segregates, apparently blowholes into which segregate has been squeezed after their formation.

The volume of the blowholes cannot be regulated closely, and hence it is usually restricted so that it is too small to close the pipe completely. In this case it is an incomplete remedy of one defect at the cost of introducing two others, the blowholes themselves and the segregation which they induce, as explained below. Moreover, blowholes are spaces into which the minute pocketfuls of local segregates can be squeezed, by the pressure generated spontaneously within the ingot, thus forming masses so large that their diffusion is far less complete than it would have been had they remained in their initial inter-dendritic positions. In the case of basic open-hearth boiler-plate ingots these defects are relatively harmless, because the blowholes weld readily in this low-carbon metal, and because it is so pure that its segregation is not serious, the segregate being buried away in the middle of the plate, both at the neutral axis and away from corrosion.

In general to prevent piping by creating blowholes seems the least intelligent though often much the cheapest method. In the case of the higher carbon steels and the alloy steels it is hardly to be considered, because here the blowholes will not weld. We may question

Fig. 2—Castings Showing Position of the Segregate. Casting A is the lower and casting B the upper half

whether it is consistent with proper regard for the lives of travelers to tolerate this practice in making rail ingots.

Of the various deoxidizing additions for preventing blowholes, by removing the oxygen which otherwise would combine with the carbon present to form carbonic oxide gas, that would seem the best which, while deoxidizing the metal thoroughly, yields a fusible or rather a coalescing slag which will swim to the surface and escape. The composition of the slag must needs vary, for any one kind of addition, with the quantity of oxide to be removed, which in turn must vary from heat to heat. Direct experiments are needed urgently to show what combination of these additions will, under the probable range of oxygen content of the metal, yield the most thoroughly self-expelling slag. The thorough-

ness with which blowholes, and their result, segregation, have been suppressed in this or that heat by one or another deoxidizer is weak evidence. I have heard of no attempt to answer this question intelligently.

The formation of the pipe being due to a difference between the various layers as regards their rates of contraction, none could form if there were no such difference, and its volume and depth must clearly decrease as this difference decreases, being for instance much less when a wide ingot solidifies in a soaking-pit than when a narrow one solidifies in a strong winter's wind. Rapid solidification increases the formation of blowholes, as is shown by the great excess of those in the left hand or chilled side over those on the right hand or slowly cooled side of casting *C*, Fig. 4.

Fig. 3—Structure of a Casting Cast in a Mold of Which the Right Hand Was Iron and the Left Hand Clay. The pipe has been moved to the left

SEGREGATION

Solidification is a process of differentiation. The carbon content of the particles of solid metal which first deposit on the sides of the mold is only a certain fixed* percentage of that of the molten out of which they deposit. So with the phosphorus and sulphur. They may here be left out of account, because what is true of carbon is true of them. Because this process enriches the molten progressively, and because the carbon content of the solid particles deposited at any instant is proportional to that of the molten out of which they deposit, the carbon content of the successive solid layers as they deposit increases progressively from beginning to end of the solidification. Hence the successive positions of the tectotherm are recorded permanently by successive lines of nearly equal carbon content, or isocarbs, the carbon content being smallest at the outer crust and greatest at the last solidifying point.

The Onion and Landlocking Types of Solidification.—The condition just described assumes that the successive layers which deposit are smooth and concentric, or at least co-axial with the mold, like the layers of an onion. But instead of landlocking solidification may occur by the inshooting of pine-tree growths from the sides. The interlacing boughs of these pine-trees landlock the metal, so that the progressive enrichment, instead of being from the outer crust of the ingot as a whole to its axial last freezing point, is from surface to center of each one of these little pockets.

Even in this case there is some concentration of carbon from the outer to the last freezing parts of the ingot as a whole, but the concentration is much less than in the onion type, a large part of the carbon which in the onion type is crowded progressively to the last freezing axial point being locked up locally in these little pockets.

We may surmise that the columnar outer part of the ingot has solidified pine-tree wise, and the granular inner part onionwise. When the pine-tree type is replaced thus at the end of the columnar region by the onion type, the type of segregation changes with it from being local, little pools of molten concentrating their carbon into their own little centers, to being general, the mass as a whole henceforth cencentrating its carbon toward its last freezing part in the axis of the ingot. This implies a sudden increase in the thoroughness with which the carbon is moved toward the last freezing part of the ingot as a whole and away from these layers now solidifying.

Hence arises what is often called *negative segregation*, which means only that the impoverishment of these relatively early freezing layers is no longer interfered with by local retention of the carbon in little pine-tree pockets, so that as we pass horizontally from the columnar region in the lower part of the ingot into the granular part, the carbon content decreases, and sometimes very considerably.

The landlocking type of solidification and segregation should yield greater homogeneousness, first because it lessens the axial enrichment, and second because its local variations in carbon cover such small distances that they are readily effaced, or at least greatly lessened, by diffusion aided by the kneading of rolling and forging.

Lessening Segregation.—The most effective means is quiet, probably because this leads to undercooling and hence to the pine-tree landlocking type of solidification, as explained in the discussion of Mr. Kenney's paper* at our last meeting. The boiling caused by the rise of part of the gas of which the remainder causes blowholes is the greatest disturber of quiet, and hence wildness is the greatest aggravator of segregation. In most cases the rational procedure is to quiet the steel completely so as to prevent blowholes, and thereby to lessen segregation, and in addition to prevent, in the ways sketched above, the pipe which the absence of blowholes tends to cause. The effect of quiet is illustrated by a comparison of the quiet steel of Fig. 3 with the wild steel of Fig. 4. Though each of the pyramids of Fig. 3 is about thrice as large as the prism of Fig. 4, the volume of the segregate in the latter seems larger than in the former. Casting *A* of Fig. 3 shows a fine colonial dendritic structure, with little local segregates landlocked between the trunks and branches.

Probable additional means of making the solidification landlocking, and thereby lessening segregation, are to induce rapid solidification by means of a casting

*Fixed for given carbon content of the molten. As this content varies, the ratio which it bears to the carbon content of the depositing layers varies slightly, but not to a degree that concerns us here.

*Edward F. Kenney, *The Commercial Production of Sound and Homogeneous Steel*, Proceedings of the American Iron and Steel Institute, May, 1915: (Published in THE IRON AGE, June 17, 1915.)

temperature so low that the mold walls store up but little heat before the metal begins solidifying; casting in massive cold molds which remove the heat rapidly; casting in narrow ingots which cool rapidly; and early stripping. Of course to hasten solidification is to deepen the pipe.

POSITION OF THE SEGREGATE

We have seen that at every stage during solidification the existing bottom of the void or pipe is the existing upper surface of the molten.

This is true also of the last stage of solidification, when the molten is reduced to its last drop. With the freezing of that last drop the bottom of the pipe becomes the bottom of that drop. Because that drop is the final product of the continuous process of enrichment, it is the richest spot of all. Hence the richest spot lies at the bottom of the pipe, for instance just below that of casting *A* of Fig. 3. The segregate can be seen massed below both the pipes of casting *B* of Fig. 3.

This inference is supported by the eccentricity of the segregate in casting *C*, its following the pipe to the slower cooling side of the ingot.

The position of the segregate with regard to the pipe bottom may be modified by various minor conditions. After solidification is complete the sides of the pipe may sag down enough to cover the richest spot with a considerable layer, especially if the cooling is very slow and the opportunity for sagging is therefore long. Or that drawing apart of the inner parts of the ingot which caused the pipe during solidification may continue after solidification, and thus split apart the solid metal below where the bottom of the pipe lay at the end of solidification, and so prolong the pipe below the richest spot, which will then be found on the walls of the pipe, and thus higher up than its bottom.

Because the position of the segregate is affected less than that of the bottom of the pipe by the swimming of the void and by sagging and tearing after the end of solidification, it follows the isotherms even more docilely than the pipe does. Thus in casting *B* of Fig. 3, while there is indeed segregate just below both the pipe bodies, yet there are other masses of it even lower down than the bottom of the lower pipe. Part of the segregate indeed forms a layer stretching across most of the lower edge of this casting. We may surmise that this was the very last part of this casting to solidify, and that the higher position of the pipe is due to its swimming upwards through the viscous metal.

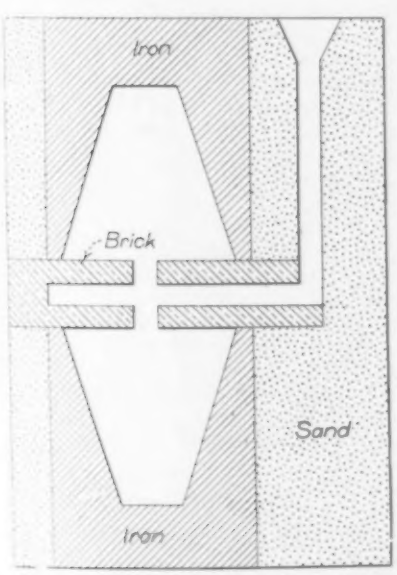


Fig. 4.—Method of Pouring Pieces Shown in Fig. 2

The high position of the segregate is often thought to be due to the lightness of the segregating elements, carbon, phosphorus, and sulphur. But its position is governed primarily by the contours of the isotherms, as is shown by its being near the bottom of casting *B* but near the top of *A*, just below the pipe bottom in each, though these were cast simultaneously from the same ladleful. This is shown also by its being at the right-hand side instead of at the axis of casting *C*, Fig. 4.

LITTORAL CONVECTION

But lightness probably contributes. The splitting-up of the layer in the act of solidifying into a fraction poorer in carbon which solidifies and one richer in carbon which remains molten, makes the layer of the molten along the walls of the cave richer in carbon than the average of the molten, and because richer lighter. Hence arises an upward convection current of the local layer thus enriched, along the walls of the cave, leading to a certain degree of stratification, the lighter and richer parts yielding readily to this upward convection, but offering a moderate resistance to any corresponding downward convection.

Any evolution of gas in the molten metal occurs at these same walls, and the rise of this gas in small amounts helps this upward convection. It may be for this reason that the upward concentration of the segregate is so marked in the casting of Fig. 4, which formed many blowholes, whereas those of Figs. 2 and 3 formed none.

Littoral convection increases upper-axial segregation in an additional way. Because the carbon content of the solid particles which deposit on the sides of the cave increases with that of the molten out of which they deposit, this lifting of the enriched shore-layers of the molten, in that it correspondingly lessens the carbon content of the molten out of which the next succeeding solid particles will deposit on the lower part of the walls of the cave, lessens their carbon content, too, while enriching correspondingly those next to deposit on the upper part of those walls.

Discussion by E. F. Kenney

Dr. Howe has given us an explanation of many of the features which we have observed in the cooling of ingots, and in the main his reasoning is corroborated by our observations. His analysis of the influences affecting the relation of the solid and molten portions of a cooling ingot is most interesting, but his statement that during the whole of the preneutral period (i. e., the period during which the outer parts cool faster than the inner), the contraction of the outer parts tends to be more rapid than that of the central ones, is not necessarily true. It would depend on the relative coefficients of contraction of the two parts. The outside walls might be cooling much faster than the molten interior, but if the coefficient of contraction of the molten metal were sufficiently great, its shrinkage might be much greater than the contraction of what Dr. Howe has called the cave. That this is what actually occurs is indicated by observations on sinkhead ingots of thoroughly deoxidized steel, which have been kept open on the top. Instead of the molten metal rising in the sinkhead, as would be produced if the contracting walls reduced the volume of the cave faster than the volume of the contained metal was reduced by shrinkage, there is a continuous lowering of the level of the molten metal.

This seems to be characteristic of all ingots cast from killed steel. In these the pipe cavity extends practically up to the top of the ingot, indicating that the shrinkage of the molten metal is greater than that of the cavity containing it practically from the time of casting. In ingots cast from steel which is not thoroughly deoxidized, and in which consequently there is an evolution of gas, forming blow holes, we have observed a condition similar to that described by Dr. Howe, and a considerable zone of solid steel is found between the top of the ingot and the top of the pipe cavity. In these cases, however, the metal continues to fill the cavity, not because the cavity is being reduced by a shrinkage of the walls, but because the volume of the molten metal is being increased by the formation of blow holes within it.

SEGREGATION AFFECTED BY UPWARD CURRENTS

There is just one other point on which I am not convinced by Dr. Howe's reasoning. This concerns the effect on segregation of the upward currents caused by the gas bubbles in a rising steel.

In my judgment this is a very important factor in the intensifying and localizing of segregation. When lively steel is poured into an ingot mold, there is a very rapid evolution of gas which causes an intense boiling in the mold. There can be little doubt that this violent boiling does keep the metal thoroughly mixed, but as the steel cools, the amount of gas evolved gets very much less. A few bubbles rise in the steel, generally along the edge of the freezing metal, bringing up with them metal which is so near its temperature of solidification, that it can be seen to freeze almost immediately after being ejected from the little craters which are kept open in the top of the ingot by the escaping gas. It is at this stage that the segregated metal is brought to the top of the ingot, and there is not sufficient downward current to overcome the tendency of the lighter, more segregated metal to remain at the top after being brought up. The marked segregation found in the zone of the deep-seated blow holes when they are present in considerable numbers, is strongly corroborative of this theory.

Mechanical Development in Sintering Materials

BY BETHUNE G. KLUGH

BETHUNE G. KLUGH

Field manager American Ore Reclamation Company, Pittsburgh.

IN considering the problem of sintering, it was early demonstrated that certain essential features of operation must be determined and maintained constantly under control, in order to produce maximum quality and quantity of sintered product. The requirements include:

1. Maintenance of accurate and uniform proportioning of the various materials which make up the sintering mixture.

2. Maintenance of homogeneous mixing of these materials.

3. Accurate proportioning and mixing of the water required to be added for producing the ideal moisture content for a sintering mixture.

4. Delivery of the sintering mixture to the sintering device so as to permit the most permeable and homogeneous bed over the entire hearth area, and a readily adjustable depth of charge to that which proves most efficient for the specific material treated.

5. Ignition of the surface of the sintering charge with proper and uniform intensity over the entire surface.

6. Exhausting the waste gases so as to conduct through the interstices of the charge the largest volume of air that can be usefully applied, but so as to avoid an excessive pressure which would compact the charge and thus reduce its permeability.

The purpose of this paper is to describe the mechanical improvements that have contributed to the progress made in sintering iron bearing materials by the Dwight and Lloyd continuous process. The above mentioned features are those which apply to the sintering operation itself, and each one is attained through mechanical means. In addition to these operations, it is obviously essential that all the work of handling material and product to and from the plant be done efficiently and economically, in order that the operation be commercial.

TYPES OF SINTERING PLANTS

Two types of general arrangement of sintering plants have been developed:

1. That with storage bins placed on the ground, in which the proportioning of the sintering mixture is effected, and the mixture then elevated.

2. That with storage bins elevated so that only one elevating operation is required, and all handling after proportioning is accomplished by gravity.

While all elevating and conveying machinery is an item of expense as to maintenance, a certain amount is necessary in order that all the functions be most efficiently performed. Bucket elevators, inclined belt conveyors, grab buckets and skip hoists are all applicable to sintering-plant operation, depending upon local plant standards and conditions. The types adopted should, of course, be selected by considerations in the order named:

1. Efficient operation.
2. Low maintenance and operating costs.
3. Low installation cost.

The materials treated include flue dust, magnetic concentrates, pyrites cinders, high sulphur magnetites, hematites, also plastic and hydrated ores. Regardless of what material it is purposed to treat at any particular works, it is not probable that this material will be treated exclusively throughout the life of the sintering plant. Therefore, it is necessary that the handling equipment installed be applicable to as wide a range of materials as it is possible to make it.

One plant that was installed for the exclusive treatment of flue dust has in three years of its existence sintered and desulphurized, on a commercial scale, flue dust, magnetic concentrates, pyrites cinders and hydrated hematite ores.

SCREENING THE MATERIALS

At the present time flue dust is the material which has the greatest sintering interest. Flue dust should be screened prior to sintering. The larger sizes of coke, that it, sizes larger than ½ in., have no value as a sintering fuel, but have a value for other purposes when screened free from flue dust. All of the various types of screens on the market have been used for screening flue dust. The usual types of revolving and reciprocating screens have been somewhat disappointing. Perfectly dry flue dust as taken from the dust catcher can be effectively separated on almost any type of screen. However, it is essential to provide for the screening of stockpile flue dust, which is delivered to the sintering plant in a moist condition, usually with 5 to 18 per cent moisture.

The American Ore Reclamation Company has developed a screen upon a somewhat novel principle, which screens flue dust of the above character and delivers oversize coke sufficiently clean for use as a blast-furnace fuel, and other purposes, according to size.

The special characteristics of the screen are its self-feeding and self-cleaning features. A modification of this screen has been installed at the Central Furnaces plant of the American Steel & Wire Company. Its arrangement, which was developed by the mechanical department of the above works, is very ingenious, in that the flue dust is delivered to the screen directly as taken from the stockpile by the grab bucket. The advantages of this particular arrangement are purely local, and in a new plant such a screen should be an integral part of the sintering plant, and should handle all materials.

Fig. 1 shows the Central Furnaces screen equipment, which is of the reciprocating type. In this, bars reciprocate between the stationary fingers, and its performance is very satisfactory. [The author also exhibited a drawing of a reciprocating screen in which cleaning fingers are reciprocated between stationary screen bars.]

This type of screen is recommended for flue dust, but it is applicable to other materials requiring sintering. However, magnetic concentrates and pyrites cinders usually have been subjected to sufficient screening action in their production. The arrangement of each sintering plant should utilize local conditions to best advantage, but almost universally the material to be sintered should be screened prior to placing in the sintering-plant bins.

The screen may operate integrally with the bin loading equipment, with advantageous operating costs, but such arrangement is not essential. The proportioning of the various materials which enter the sintering mixture must be accurate, in order that such proportioning be of value. If an indeterminate quantity of oversize is screened out of any constituent after the proportioning is done, accuracy is impossible.

Fig. 1—Screening Plant for Stock Pile Flue Dust at Central Furnaces, Cleveland

Flue dust, as all experience shows, is about the most difficult material to handle. Its angle of repose has been said to be 0 deg. when dry and 90 deg. when wet. It was after considerable experience, under widely varying conditions, that the screen above described was developed.

It is, of course, desirable to take current make of flue dust direct from dust catchers to the sintering plant and thus eliminate the expense of unloading and eventually reloading at the stockpile. The great disadvantage in such procedure lies in the dust nuisance involved. It is practically impossible to handle dry flue dust in any plant without filling the atmosphere of the plant with dust, with its incident detriment to all operators and to the machinery. It is practically impossible to moisten hot and dry flue dust effectively by the usual means of a hose. A puddle of water may be placed on top of a car of hot flue dust and the material remain hot a foot below. The dumping together of wet and of hot flue dust has often caused disastrous effects due to precipitating hot dust upon workmen.

The problem has been very satisfactory solved by the following procedure: The car of dry dust is dumped into a receiving hopper; the dust thrown into the atmosphere from this dumping operation is considerable, but it is only momentary and is outside the plant. The material is then delivered to a screen and passed from the screen directly into a short pug mill and moistened. The feeders from the receiving hopper as well as the screen and pug mill are wholly enclosed so that no dust is thrown into the surrounding atmosphere. The material leaving the short pug mill contains just sufficient moisture to prevent any dust being thrown into the atmosphere, and yet giving it a free flow angle. The description of this detail may appear of a kindergarten nature, but the small operation described has satisfactorily solved the dust problem in some sintering plants.

PROPORTIONING THE MATERIALS

In order that two or more finely divided solid materials be accurately and continuously proportioned, a feeding device of simple, accurate and dependable characteristics should be provided. After trying a number of types and various modifications of these types, a modified form of the revolving disc feeder has proved satisfactory. The form finally adopted is shown in Fig. 2. This feeder has the following desirable characteristics for this service:

1. Positive volumetric discharge from the bin.

2. By its motion it tends to make the bin discharge uniformly on all sides.

3. Subject to adjustment in two ways: (a) height of discharge gate; (b) speed of disc.

4. Mechanically simple, requiring only one bearing for support.

5. Subject to multiple control, as any number of feeders may be geared together in positive operating unison.

6. Very slow moving, which is conducive to lowest cost of mechanical maintenance.

MIXING DEVICES

For accurate mixing of the proportioned materials several devices are on the market. We have, however, developed a pug mill which handles and mixes any materials satisfactorily, whether plastic or granular. All gears and bearings are made practically dust-tight; the wearing portions of the blades are changeable; with very slight expense and loss of time the shaft carrying the blades may be removed bodily without disturbing the bearings, and the bottom may be dropped for cleaning, while running. Thus for moderate expense a mixer embodying all desired characteristics can be provided.

It is the custom in the design of our sintering plants for the pug mill to be placed immediately preceding the delivery of the material to the sintering machine. This permits immediate adjustment of moisture content of the sintering mixture. This is a most important factor in operation as a slight change in the physical quality of the material will require immediate adjustment of the moisture content of the mixture in order that the sintering be maintained at the highest degree of efficiency. With slight training an operator may note, immediately after the ignition, a change in moisture requirement of the sintering nature, and by means of valves on the pug

mill water supply effect the proper adjustment of this item in five minutes of operation.

DISTRIBUTION OF MATERIALS ON THE HEARTH

For making a perfectly uniform distribution of the mixture over the entire hearth area, we have tried out in actual practice a number of devices, too numerous to mention and not of present interest. The simple and effective swinging spout has solved the problem very satisfactorily; as the line of pallets moves in a continuous straight line, the swinging spout moving across this line of pallets, maintains the uniform deposition of the sintering mixture. In this way changing the direction of the entire stream continuously gives uniform structure to the entire bed.

When treating a highly variable material such as flue dust, it is necessary to change the depth of this

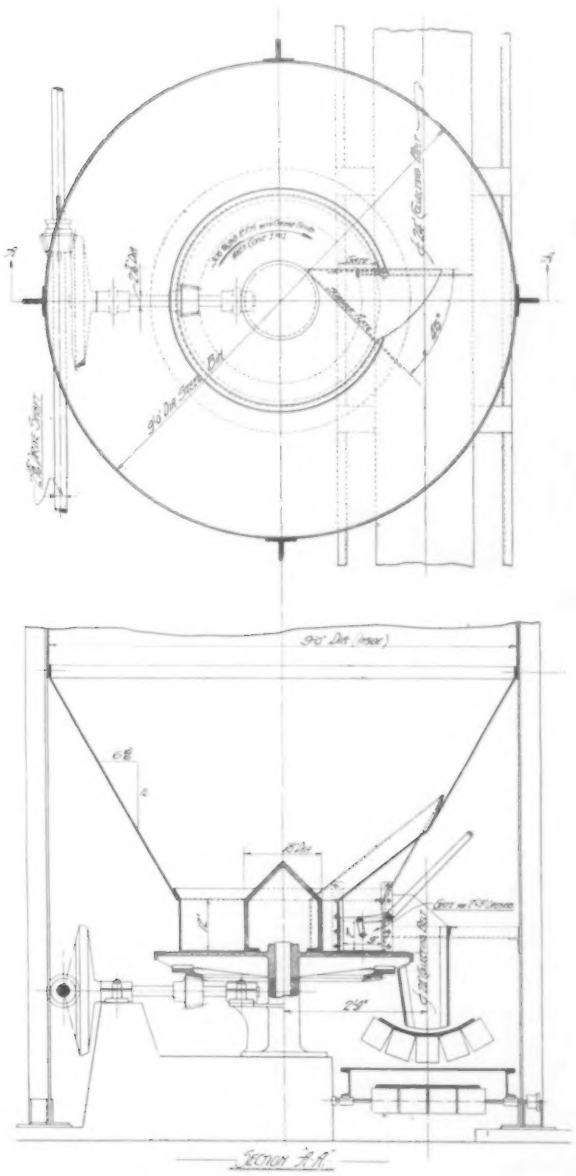


Fig. 2—Revolving Disk Feeder for Proportioning Materials

layer from time to time, as changes in the characteristics of the flue dust demand. There is always some critical thickness of charge for any specific material at which the greatest quantity and the best quality of sinter is produced. The system of bins and proportioning feeders, mentioned before, will readily strike the best average of the sintering mixture, when the material is fairly uniform, and hence the depth of charge can be held constant; but when flue dust is the material treated, it will be found to vary from day to day in fineness, so that the thickness of layer at which the best sintering is performed will vary 50 to 100 per cent. Operators should watch carefully such changes and make necessary adjustments for the same.

The super-hopper, which is above the pug mill, is in no sense an auxiliary storage, but is simply a feeder, the function of which is to hold enough material to maintain the sintering layer at a given depth. In order to prevent undue surcharge in this hopper, which interferes with the regularity of feed, it is very essential that the quantity of material delivered to the sintering machine be exactly its capacity under existing conditions. The feeder or group of feeders which deliver this sintering mixture must synchronize with the speed of the pallets. Obviously the solution of this requirement is to gear the feeders and the sintering machine together. The absence of any transmission elements conducive to slippage is desirable, because the synchronism must be positive in order to be of value. This arrangement is used where the sintering mixture is delivered to a super-hopper after being proportioned, and where the moisture requirements of the mixture must be changed to conform to changes in the raw material. Flue dust is one material especially referred to in the latter statement.

Where the material to be sintered is of a homogeneous nature, such as ores or concentrates, the pugging may be done immediately following the proportioning feeders. In this case the super-hopper should be mounted directly above the sintering machine feeder, and the feeder is driven directly from the sintering machine gearing. This gives a very desirable arrangement in that the feeders are always in sight of the operator.

Fig. 3 illustrates a plant that is now being constructed for the Toledo Furnace Company, Toledo, Ohio, in which elevated storage bins are located within the building structure and are filled by means of an automatic skip hoist. In this plant the feeders for proportioning the sintering mixture discharge directly into the pug mills; hence, they combine the functions of proportioning feeders and super-hopper feeders. It is necessary that these feeders maintain the desired proportions accurately, and at the same time be subject to positive synchronism with the hearth speed of the sintering machine. This is accomplished by using an adjustable speed motor which drives an adjustable speed counter-shaft. The sintering machine is driven directly from the usual constant speed pulley, and the feeders, in unison, driven from the adjustable speed countershaft. The result of such arrangement is that when the various feeder gates are set to give a definite mixture, these proportions are maintained accurately, while the volume is varied at will by decreasing or increasing the speed of the feeders as set. It is noted that this set of feeders are driven by a compact and simple set of gears, any one or more of which feeders may be stopped at will by means of individual clutches. The feeders will all synchronize with the speed of the pallets, while when desired they may have their speeds changed independently of the sintering machine.

PROPER INTENSITY OF IGNITION

The next function performed upon the sintering mixture is the ignition. This ignition must be of ample intensity to ignite positively the entire surface of the charge and yet not so intense that it will dry out the charge. In the latter case the sintering mixture is prematurely dried and the sintering action retarded, with incident curtailment of output. Occasionally materials are encountered which require only very light ignition in order to produce the greatest sintering speed, while other mixtures will give best results under an ignition so intense as to leave an incipiently fused surface on the charge. No phase of this sintering art has passed through so many vicissitudes as that of ignition. Starting with a light gasoline torch, on our initial plant, we have passed through many types of burners employing fuel oil, kerosene, bituminous coal, coal gas, natural gas and blast furnace gas.

Fig. 4 shows the ignition burner now in use, which fulfils all requirements for effective ignition, viz., adjustability, durability and economy of fuel. The present burner is of a lower first cost than any of the previous types employed. It is interchangeable for natural gas, illuminating gas, blast furnace gas or fuel oil, simply by change of mixers. With this burner there

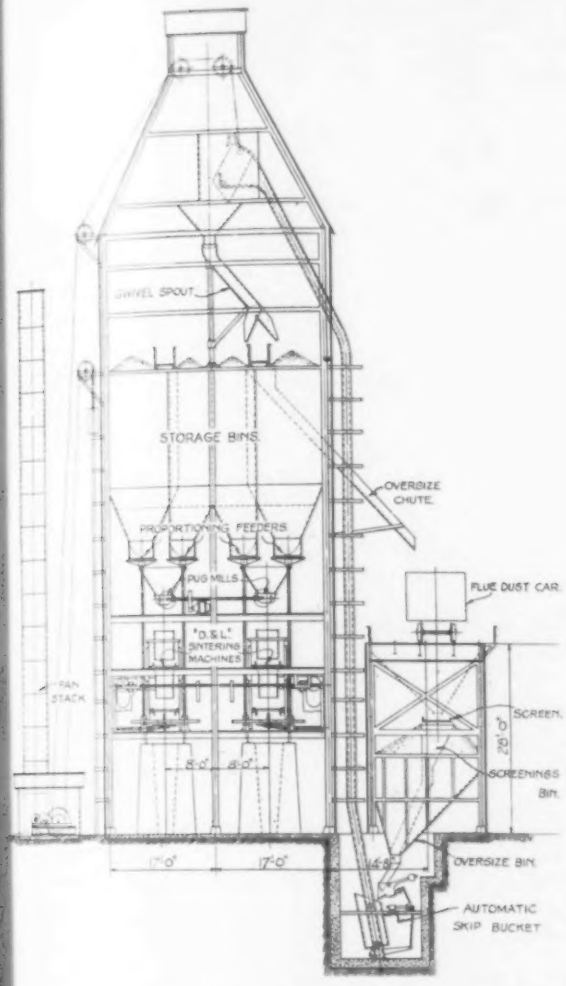


Fig. 3—Sintering Plant of Toledo Furnace Company

was accomplished the use of blast furnace gas as an ignition fuel with no mixture of other fuel whatever. Blast furnace gas has been used without any trouble or delay whatever for practically two years, effecting a very important economy in sintering.

EXHAUST FANS

Up to the present time the suction for sintering has been produced by means of exhaust fans. A number of different types of fans have been tried and are still in operation. Fan engineering being a branch in itself, involving the control of many variables, there will be no resumé here of the vast amount of technical data collected relative to this work. Fans of larger diameter with low speeds have given better results than smaller fans at high speeds. The type of fan now giving satisfaction and which is recommended for pending installations is about 100 in. in wheel diameter, running at 600 to 720 r.p.m. and capable of handling about 20,000 cu. ft. of gases per minute. The continuous nature of the Dwight & Lloyd process maintains a constant load on the fan, which is decidedly advantageous to the use of fans of large capacity.

SIZES OF SINTERING MACHINES

The Dwight & Lloyd sintering machine is made in three sizes, to meet the varying requirements:

Small, size, 42 in. x 13 ft.; intermediate size, 42 in. x 25 ft., and large size, 60 in. x 30 ft.

The small size can be converted into the intermediate size by simply lengthening it, if it becomes necessary to make a larger output. This small size is designed for plants where the available material for sintering is from 50 to 100 tons per 24 hr. The intermediate size, now in very extensive use, will provide a daily output of 100 to 250 tons, depending upon the material treated.

The anticipation of sintering some very large tonnages of materials has shown the need for a larger size machine. A convenient and practical size which fulfils engineering requirements is the one shown in Fig. 5. This machine has a hearth area 70 per cent greater than the intermediate size and has a daily capacity of 300 to 400 tons per machine, according to the material treated. The design of this machine is more simple and much stronger in its parts than the machines previously built. These three sizes provide equipment for any capacity of sintering operation desired.

The results of the careful study of all the details involved are shown in the fact that the original product per square foot of hearth area has been in some cases trebled. A sintering plant built for operation upon pyrites cinder had a capacity, based upon work done at the initial plant, of 75 tons per day per machine, but has now reached a production of over 200 tons per day per machine. Another plant constructed for a capacity of 75 tons per day per machine from flue dust, is making an average of 170 tons per day per machine. The first machine installed was of the same size as all of the machines now in use. In its first year of operation it scarcely exceeded an average of 50 tons of product per day. After being re-equipped with auxiliary apparatus, as good as local conditions would permit, it now exceeds 150 tons of product per day, and is successfully treating ore carrying sulphur. Since the first installation of the Dwight & Lloyd machines for the treatment of iron bearing materials, four years ago, and without changing the size of the machine, its daily capacity has been increased over 200 per cent and its ultimate capacity has not been reached. In existing plants there are noted improvements which can be made, and from which continued development is confidently expected.

ADVANTAGE OF ADDING FINE ORE TO MIXTURE

The betterment of the finer grades of ores at existing mines is worthy of attention. Many of the Mesaba range mines carry ore that is objectionably fine for

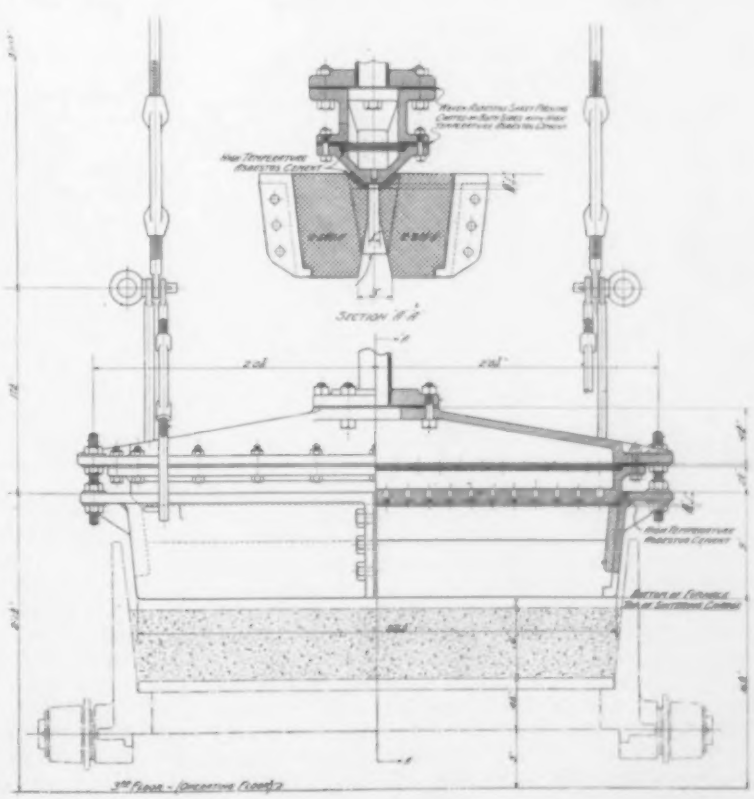


Fig. 4—Burner for Utilizing Blast Furnace Gas

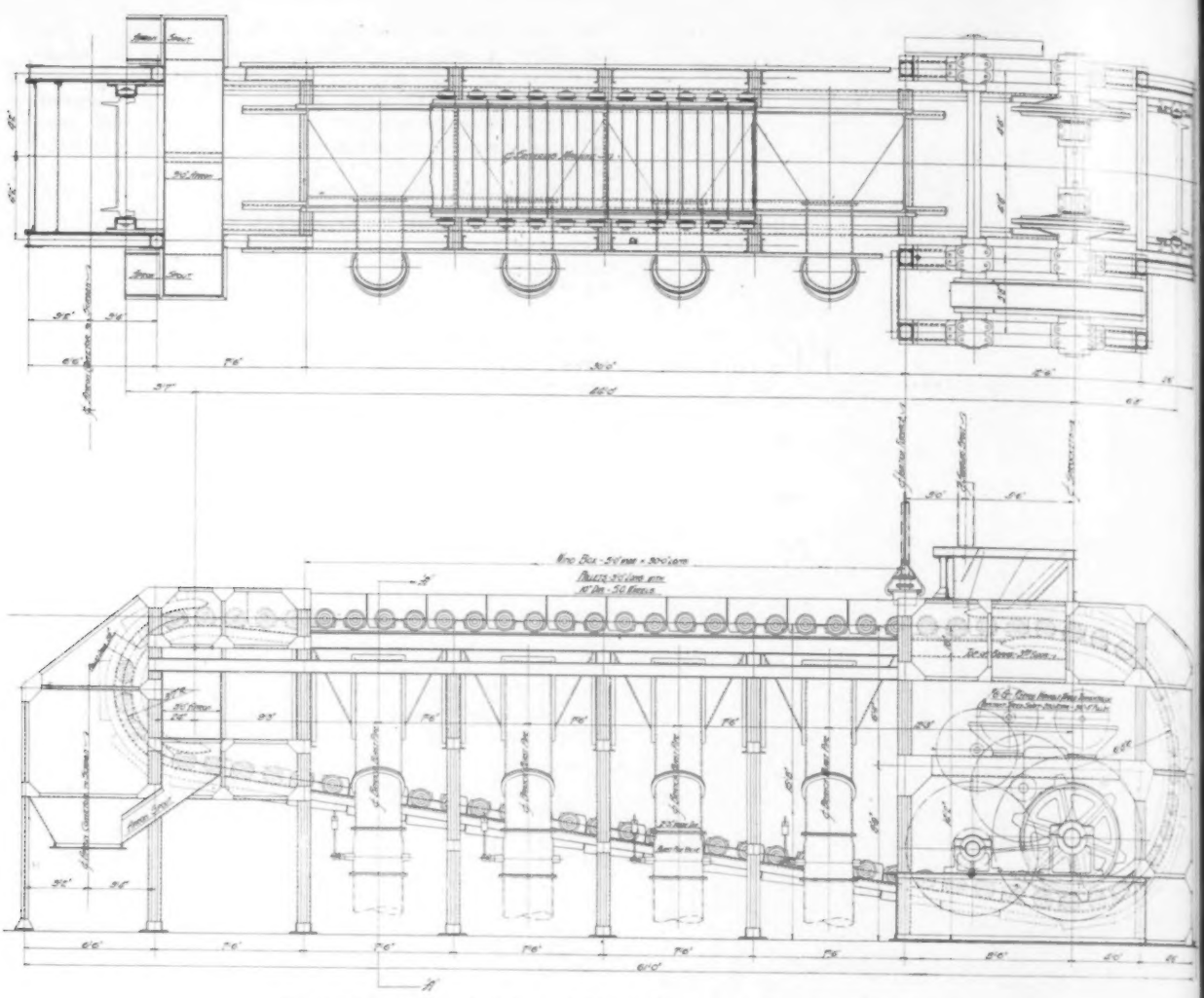


Fig. 5—Large Size Dwight and Lloyd Continuous Sintering Machine

furnace use. If these ores were mixed with flue dust, and the surplus carbon in most of the flue dust make, utilized for sintering the finer ores, the cost of so treating the ores would be nominal. Take for example a supply of flue dust that carries a carbon content double the amount that is necessary for sintering, and assume that the quantity treated daily is 100 tons. To this flue dust could be added an equal amount of fine ore and the total expenditure for sintering operations would be practically the same for treating 200 tons of the mixture as for 100 tons of the flue dust. The flue dust, being a waste product, requires a certain expenditure per ton to reclaim it as sinter, while the fine ore, being new material and costing the same per ton as first-class ore, can be converted into a product in every way as good as the most desirable ore, at practically the cost of conversion assessed against the flue dust sinter alone.

The sintering and desulphurizing of fine ores and concentrates is daily opening into a wider field. The fear that with the development of the iron industry and the increased consumption of ore, that much leaner ores must be used, is obviated by the use of the sintering process. There is probably more metal disseminated through rocks carrying 35 to 40 per cent iron than in the known rich deposits in this country, and which can readily be reclaimed. The concentration of these magnetic ores has in many cases produced a product which, while rich in iron, has also been so fine in size as to make it undesirable for blast furnace use; but the sintering of these concentrates converts them at low cost into a mass, cellular in structure, rich in iron and highly desirable for blast furnace use. The relation of fine ores to sinter is best described as that of flour to biscuits, and in each case the treated product is more readily digested. The waste paint rock of the Mesaba mines, carrying 22 per cent water, responds readily to sintering and yields an ore with 52 per cent iron. There is a large annual tonnage of burnt pyrites which can be converted by sintering into a valuable ore, and when the copper is objectionably high, it can be leached out before sintering. It is evident, therefore, that the development of the sintering process secures to the iron industry a supply of rich ore, for a long distance into the future.

Discussion by Robert E. Brooke*

The first sintering plant for treating iron flue dust was built at our furnace at Birdsboro in the summer of 1911 and started its operation in October of that year, to sinter the flue dirt accumulation there. The machine was of the then standard size, 42 in. x 22 ft., and the tonnage hoped for was 75 to 80 tons per day of 24 hr., but not nearly this amount was reached, the average daily product being more nearly 40 to 50 tons per day. The best daily tonnage for the plant reached 65 tons in the 24-hr. run on flue dirt, a high record.

Mr. Klugh was in charge of these sintering operations and the great variability in flue dirt composition and the other difficulties in mixing, feeding and ignition, were presented to him and largely overcome by his experiments at this plant. As we, of course, wished to increase our product of sinter, we took the matter up with the American Ore Reclamation Company, engineer, and at the suggestion of that company, last winter, installed a larger elevator, capable of carrying 300 tons daily, instead of 100 tons, which was the best the old elevator could do. We also put in a super-hopper, into which the present elevator feeds the material. This super-hopper holds about an hour's run and its use tends to mix the material more thoroughly and with the feeder at the bottom we obtain a good, steady layer of material running to the new double-shaft pug mill, which has a much enlarged capacity over the old one. From the end of this pug mill the ore drops directly into a swinging spout, which gives it a much better distribution as it reaches the pallets. In the receiving

*E. & G. Brooke Iron Company, Birdsboro, Pa.

hopper below this spout, a deflecting plate at an angle of 45 deg. breaks the fall, thereby preventing the packing of the material on the grates and sending the larger particles to the bottom of the layer on the pallets, leaving the finer on top. The finer material contains the finer particles of carbon and makes uniform ignition more easy. We find it of advantage that as little material should rest in this receiving hopper as possible. We formerly used fuel oil for ignition, but are now using illuminating gas, and within the next week or so expect to use blast furnace gas.

The changes have enabled us to increase the speed of the moving pallets from about 12 in. per minute to 19 and 20 in., and the thickness of our layer from 4 to 5½ in. Our fan has not been changed as yet, being the original 66-in. diamater wheel installed, but we have increased the speed from 700 to 900 r.p.m., which is about the limit of our motor. We have put in a new stack 150 ft. high, to carry off the sulphur fumes.

DESULPHURIZING PROPERTY OF THE PROCESS

In this connection, it is only fair to say that we are not running at present on flue dirt, except as we use it in the mixture to give us the carbon required for sintering fuel. The sinter we are making is derived from a high-sulphur magnetic ore which we crush in a Buchanan crusher and in rolls and then pass through a ¾-in. screen, the sulphur running over 3 per cent in the crude ore and being reduced by sintering to a maximum of 0.21 per cent. The sinter comes off the pallets in large cakes and seems to work very satisfactorily in the furnace.

The product from the sintering machine for the 31 days from Oct. 4 has been 134.8 tons per day of 24 hr. We expect to make over 4000 tons this month. When we do not have enough flue dirt for admixture with the ore, we use screened coke dirt, the sintering mixture requiring only about 5 per cent of fuel. We do not believe we would obtain this tonnage when running on flue dirt alone, with our present equipment.

To increase our tonnage further, we are about to install an American Blower Company double-inlet fan, with a 100-in. diameter wheel, which is on the ground, because it seems clearly proved that larger tonnages are in proportion to the volume of wind. With this fan, we confidently look forward to obtaining 250 tons of sinter per day. When the fan is installed, we shall have to raise the sides of our pallets about 3 in., which will enable us to use a thicker layer.

FURNACE PERFORMANCE WITH SINTER

In the summer of 1913 we saved up some of this sintered ore and made a test of a two weeks' run on practically 25 per cent of the furnace mixture. As the sintered ore contained 55 per cent iron, we decided to substitute it for the following ores:

7/16 Old Range ore, running.....	48.47 per cent iron
7/16 Mesaba ore, running.....	52.37 per cent iron
1/16 Port Henry concentrates, running...	65.00 per cent iron

The Port Henry concentrates brought the average yield of the replaced ores up to 53.52 per cent iron, which was 1.5 per cent below the sintered material. For the four weeks preceding the test, the average fuel was 2130 lb., railroad weights, the ore yield 56.53 per cent iron, and the product 6833 tons of basic iron. We started to put the sintered ore on the week of Aug. 17 to 23, which is included in the last figures above, as only 6.4 per cent of sinter was used in that one week. The following week we had 21.44 per cent of sintered ore on, replacing the other ores mentioned above, and our fuel per ton of iron was 2080 lb., the yield 59.40 per cent iron, and the product 1715 tons, and the week of Aug. 31 to Sept. 6, we had the full 25 per cent of sintered ore on and the fuel was 2070 lb., railroad weights, the yield 58.64 per cent iron and the product 1707 tons.

As mentioned above, the average yield for the four weeks preceding the test was 56.53 per cent iron. With the increase in iron content by putting 4/16 of the mixture of sinter running 55 per cent iron, against the replaced ores, running 53.52 per cent, the total ore yield should have increased, theoretically, to 56.90 per cent, whereas it actually went to 59.40 per cent and 58.64 per cent respectively for the two weeks of the test, showing that the sinter did not blow out through the downcomers, as much as the replaced ores.

At present we have in our mixture: 6/16 sintered ore, 7/16 New Jersey and New York magnetic ore, 2/16 manganate, 1/16 heating cinder, mixed with a little roll scale.

We have had this mixture on practically for three weeks. The first week mentioned, ending Oct. 2, we made foundry iron, 2X, chiefly, and the fuel was 2207 lb., the yield 61.93 per cent, and the product 1589 tons. The second week mentioned we changed to basic, but the furnace being overblown during the early part of the week, made some white iron and the engines had to be pulled back. The product was 1688 tons and the fuel 2044 lb., railroad weights. The furnace had some extra scrap during these two weeks.

The third week, ended Oct. 16, the furnace steadied down on basic, making no misfit. Our fuel was 2199 lb., railroad weights, our limestone was 29.3 per cent of the ore. The theoretical yield of the ore mixture was 55.50 per cent, and the actual yield was 58.59 per cent. The furnace has been doing better work over the last ten days or more, the burden having been gradually increased from 13,600 lb. to 14,800 lb., and at the same time we have gradually put our engines up from 19,500 cu. ft. to 20,750 cu. ft. per minute, with increasing daily tonnages. During the period mentioned the furnace has not been receiving any extra scrap, so it is evident our ores are staying in the furnace.

For the first four days of this week our product has been 252 tons per day, fuel 2120 lb., railroad weights, ore yield 58.40 per cent, and stone 27 per cent of ore. All the casts were standard basic iron. Our experience thus far with the sintering process certainly leads us to believe that the product equals a very high-grade ore.

Discussion by Hermann A. Brassert

The sintering problem has resolved itself largely into one of cost of installation and operation. This in turn has narrowed the choice, at least for the sintering of flue dust, down to two processes—the down-draft and the rotary kiln. My intimate practical experience has been with the chain cleaned rotary kiln. The one at South Works of the Illinois Steel Company was the first of its kind installed, and has been successfully operated for the past ten years. Comparing the two processes, the down-draft process has the advantage of minimum cost of fuel and low cost of installation. It uses no outside fuel except that for ignition, and depends on the carbon content of the dust alone for the heat required to accomplish sintering. For that reason it is sensitive to the variations in chemical analysis of the dust, particularly of the carbon content, and hence the importance of correct proportioning and thorough mixing of materials to give a charge of advantageous and regular composition. The necessity of distributing the draft evenly through the entire bed of material, calls for a high degree of physical uniformity. Through establishing the proper relation between the thickness of the bed and the fan suction, the rate of sintering has been greatly accelerated.

THE ROTARY KILN PROCESS

The rotary kiln, on the other hand, uses more or less external fuel, and it is for that reason that the process is not so sensitive in regard to the varying qualities of the flue dust. The kiln is mechanically the simplest sintering device, and like the Dwight-Lloyd, serves at the same time as conveyor for the material through the process. With the plain kiln, the main difficulty has been the building up of sintered material on the walls. These ring-shaped accumulations have to be removed at intervals, unless the walls are permanently kept clean by means of a scraper chain. This chain is an essential accessory, since it eliminates the shut-downs, even when flue dust only is used, except for relining of the kiln, which at South Chicago has to

(Continued on page 1025)

ESTABLISHED 1855

THE IRON AGE

EDITORS:
A. I. FINDLEY
GEO. W. COPE W. W. MACON
CHARLES S. BAUR, *Advertising Manager*

Published Every Thursday by the DAVID WILLIAMS CO., 239 West Thirty-ninth Street, New York

W. H. Taylor, *Pres. and Treas.* Charles G. Phillips, *Vice-Pres.* Fritz J. Frank, *Secretary* M. C. Robbins, *Gen. Mgr.*

BRANCH OFFICES—Chicago: Otis Building. Pittsburgh: Park Building. Boston: Equitable Building. Philadelphia: Real Estate Trust Building. Cleveland: New England Building. Cincinnati: Mercantile Library Building.

Subscription Price: United States and Mexico, $5.00 per year; single copy, 20 cents; to Canada, $7.50 per year; to other foreign countries, $10.00 per year. Entered at the New York Post Office as Second-class Mail Matter.

Steel Trade Prospects

A greater contrast could not well be imagined than that shown by the opinions on steel trade conditions expressed at the Cleveland meeting of the American Iron and Steel Institute last week and those which came out at the Birmingham meeting one year ago. Then the industry was feeling the full effect of the shipping embargo and the reaction from the early belief that with Europe at war this country would come quickly into command of world markets. In the South the mistaken "buy-a-bale" movement was in its first stages and the cotton States were full of forebodings. Every stock exchange in the country was closed. The autumn financial strain was beginning to be felt and the relief to come from the new banking system was some weeks in the distance. Steel exports were shrinking and the outlook for domestic trade was most unfavorable. Two days before the Birmingham meeting the Steel Corporation had reduced the dividend on its common stock 60 per cent and throughout the industry wage reductions seemed inevitable.

At Cleveland last week, with a larger representation of all branches of the steel trade than has been seen at any like gathering, there was no dissent from the view that in many of its favorable aspects the present situation is without a parallel. Domestic production of steel is at the highest rate ever known. Prices have reached levels yielding highly satisfactory profits, though it is not overlooked that current shipments of some finished materials, particularly the heavier forms, are at considerably lower prices than now prevail. Such a scale of operations was not looked for, even so recently as at the beginning of September, as is well illustrated by what happened on the Lakes. Between late August and late September, forty freight boats went into commission that had been idle the entire season up to that period. A number of iron-ore consumers, realizing as fall advanced that their supplies were insufficient to last until the opening of navigation, tried to make purchases, but found that heavy grain transport had forced the ore rate from Lake Superior to $2 per ton, and that no more ore than was already under charter would be brought down. It was one of those swift changes which the iron trade has often seen but never foresees.

In the views for which the Cleveland meeting was the clearing house it was agreed that domestic demand in the entire year since the Birmingham meeting had been unsatisfactory. The belief was common that but for the war steel manufacturers to-day would be suffering positive hardship. The facts brought out as to iron and steel exports, as already given by THE IRON AGE, were that such shipments of materials reported by weight are at the rate of 5,000,000 tons or more a year, while those reported only in values—automobiles, cars, machinery of every description, implements, munitions and scores of other classes—may now be at the rate of 2,000,000 to 3,000,000 tons a year more. But apart from these figures, it was argued, is all the iron and steel ordered for home consumption by manufacturers who are providing room and equipment for the manufacture of product for European armies or for export to consumers whom European workshops cannot now supply. Some of the railroad buying, for example, is to take care of the large traffic going to Europe. Thus all the way from 30 to 40 per cent of present iron and steel production is considered to be attributable directly or indirectly to the war. Some estimates are even higher.

Judge Gary expressed the opinion in his opening address that a reaction from the present prosperity in the steel trade is to be looked for on the ending of the war unless steps are taken to protect the home industry against the inroads of cheap European products that would be pressed for sale here. Leaders in the industry quite generally take this view. They decidedly disagree with those writers who have urged that the industries of this country will be drawn upon in a large way in the process of Europe's physical reconstruction and who fail to consider that the workshops of the belligerent nations which have been so largely kept busy meeting the demands of their armies must find employment later in this very reconstruction which peace will bring. In the case of Germany, moreover, there are no waste towns to be rebuilt. Her industrial energies can be turned quickly to the rebuilding of export trade and to crowding cheap products into least resistant countries like the United States.

In all such speculation on what the American steel trade may expect after the war, there come up the long deferred needs of our railroads and the buying in many lines that must follow these recent years of sub-normal demand in which all industry

has been under the harrow. Our own Government's program of iron and steel consumption is no small factor in these calculations. With another year of accumulations at the present rate, the country's money and credit resources would not only suffice for vast expansion at home, but for the financing of many enterprises in South America and elsewhere, for which Europe could do nothing for years.

For the most part, however, the steel manufacturers who gathered at Cleveland are concerning themselves less with these post-bellum problems than with calculations for the operation of their works in 1916. Barring an early termination of the war, full employment for the industry in the coming year is counted on, with production and profits beyond anything on record.

Our South American Trade

While the rapid growth in our iron and steel exports in recent months has been largely due to heavy exports to England, France and Russia, there has been a very considerable increase in exports to neutral countries. This latter increase has been due in part to the exhaustion or partial exhaustion of stocks carried at the time the war broke out, and partly to a betterment in conditions whereby the buying power of neutral countries has improved. While the United States Government statistics of exports as issued monthly do not give in great detail the segregation as to country of destination, they cover enough items in such detail to show that there has been a very distinct improvement, as compared with the early months of the war, and in some instances the exports are now much larger than before the war. The trend is undoubtedly in the right direction; in other words, the worst was experienced early in the war.

Of particular interest is the case of South America. Figures compiled by the foreign trade department of the National City Bank of New York show that in the four weeks ended Sept. 26 the exports of all kinds of merchandise from the port of New York to South America aggregated in value $9,550,398, against $5,758,566 in the corresponding period of 1914. About 85 per cent of United States exports to South America go from this port. Bearing upon the trade outlook in that quarter is an interesting report just issued by the Department of Commerce, made by a special agent who investigated financial conditions in Argentina, Brazil, Bolivia, Chile, Peru and Uruguay.

The South American countries are evidently to be differentiated as to financial conditions preceding the war and also as to effects caused by the war. Argentina experienced a sharp crisis in 1913, and the war accentuated the depression that followed. Brazil suffered from a depression rather than a crisis before the war, but the war developed a crisis. Chile was feeling a relatively slight depression before the war, but the war at once developed a very serious situation, as Chile is distinctively a one-product country, exporting nitrates and nitrate products, and this movement was almost completely shut off, and London exchange could scarcely be purchased under any circumstances. By last April the business of the nitrate companies, however, had risen to about 50 per cent of capacity. In Bolivia a crisis occurred early in 1914, just before the war, attributed chiefly to declines in the prices of tin and rubber, and the war made worse a situation already bad. In Peru conditions prior to the war were fair, but the almost complete loss of shipping facilities upon the outbreak of the war caused a depression. In Uruguay, apparently, the war has had the least effect. A slight industrial depression had preceded the outbreak of the war, but the war itself had little adverse effect. European investments are comparatively small in that country, and as 90 per cent of its normal exports are live-stock products the commerce has been maintained quite well.

The crisis in Argentina in 1913, and subsequent developments in other countries, particularly after the outbreak of the war, uncovered a very bad situation, especially with respect to the extension of credit. American manufacturers who used to be urged to push their export business by granting credits similar to those given by European sellers have had excellent reason to congratulate themselves on their conservatism. Credits in Argentina were particularly loose, and many cases were developed of merchants having been granted by each of several banks a line of credit equal to the full amount to which the merchant would be entitled, the situation being due largely to competition between the banks of different countries, without any system of credit information exchange. Worse still, if possible, was the fact that in Argentina there was wild speculation in land, and much of the commercial credit extended was actually used in land speculation. The merchant would buy goods on long time and use the money, when sales were effected, to speculate in land.

According to the Department of Commerce report quoted, conditions have in general been improving at a satisfactory rate in the countries reported upon, except with respect to the situation created in Argentina by land speculation. Other credits have been liquidated, but with those based upon land practically nothing has been accomplished.

The export statistics, as already suggested, tend to show an increase in our exports to South America, including iron and steel, as would be expected from the more or less improving conditions on that continent and the exhaustion of stocks purchased before the war. Owing to the cutting off of supplies from Germany, and England's somewhat limited ability to export, our own exports are in some cases already greater than before the war. We had practically no tin-plate trade with Argentina before the war, but in the first seven months of this year we exported nearly 8000 tons to that country, valued at over half a million dollars. Great Britain furnished about the same quantity, representing a doubling as compared with the same period in 1914, while our exports were multiplied by eight. With Brazil we made a large gain also. Our exports of sheets and plates to Argentina were much larger than in the fore part of 1914, and even in excess of our heavy exports in the corresponding period of 1913. Wire products tell the same tale with respect to both Argentina and Brazil. These are practically all the direct steel mill products upon which the monthly export statistics throw light. Turning to railroad material, we find larger rail

exports to South America, as compared with records in previous years, but extremely light exports of cars and locomotives. It is evidently in iron and steel products that may be regarded as of common everyday consumption that the recovery of South America is first shown. In permanent improvements, in regular capital investments, the progress will be slower, but it seems evident that the turn has been rounded and that our iron and steel commerce with South America will continue to increase month by month.

CORRESPONDENCE

Production and Costs

To the Editor: In THE IRON AGE some little time ago appeared a resumé of Mr. Gantt's address on the relation of production and costs. Mr. Gantt gives the impression that if certain overhead is charged off to profit and loss, instead of distributed in the load which production carries, by some sleight of hand process it will vanish into thin air and need no longer be feared as an expense item.

Possibly one's mind is slow in comprehending the ultimate disposition of these items. It is quite evident that in setting the selling price of the various articles produced or quoted upon, the cost is to be relieved of a certain amount of burden, but just how this expense, which is thus thrown into the profit and loss account, is to be kept from affecting the earnings of the business, is not clear. For example, the fixed charges for the Buffalo and Albany plants, that is, those unaffected by closing down, would, if charged to profit and loss, correspondingly reduce the surplus or visibly affect the assets of the business as a whole.

This is a result which would obtain even if the Chicago plant were kept running at full capacity, for it is hardly conceivable that the most favorable cost figuring would enable that plant to earn net profits sufficiently large to offset the loss entailed by the idleness of the other two. Eventually then the time would arrive when there was no surplus or asset to take care of the steadily growing loss account. Presumably it is at some point short of this that Mr. Gantt would consider it advisable to cease manufacturing. Assuming that the directors concurred with him and closed the Chicago plant also, what then? Sell out or liquidate? Most emphatically neither!

With the prospect of accrued surplus, or whatever other term may apply, slipping away without bringing in returns, it would seem good policy to arbitrarily vote a substantial appropriation to be devoted either to expanding the company's advertising or to the closest kind of study to reduce cost of manufacturing. Nothing more could be lost than by the other procedure and it is more than probable that the result would be enough business to keep all three plants in operation.

H. D. MURPHY.

Increasing the Use of Bessemer Steel

To the Editor: I was much interested in the editorial in THE IRON AGE of Oct. 14 in favor of increasing the use of Bessemer steel where it would serve as well as open-hearth steel. It may be interesting to readers to know that all of the plates in the steamships St. Louis and St. Paul, except the boilers and some few of the lower stern plates on the hull, were made of Bessemer steel. When the St. Paul ran ashore at Long Branch some years ago the Bessemer plates in the hull and bottom stood the terrific strain all right. These plates were furnished by the Wellman Iron & Steel Company to the William Cramp & Sons Shipbuilding Company, which built the ships.

S. H. CHAUVENET.

Kingston, N. Y., Oct. 18, 1915.

Virginia Pig-Iron Rate Decision

WASHINGTON, D. C., Oct. 26, 1915—The Interstate Commerce Commission has rendered a decision prescribing rates on pig iron from Virginia furnaces to points related to Baltimore, Philadelphia, New York and Boston. This matter has been in controversy for some time, having originally been brought to the attention of the commission by the Low Moor Iron Company and other pig-iron producers. As the result of this proceeding new rates were prescribed not to exceed $2.25 per gross ton to Baltimore, $2.75 to Philadelphia, $3 to New York and $3.25 to Boston, and the defendant carriers put them in effect on shipments to those cities. The complainants then filed a supplemental petition, alleging that the defendants had not reduced the pig-iron rates to points customarily taking the same rates as the destination points specified in the decision.

In ruling on this fresh case the commission holds against the carriers and in a sweeping decision establishing rates covering a wide scope of territory it says:

(a) Pig iron in carloads to points in New England reached by the lines of the defendants which immediately prior to June 9, 1914, took the flat Boston rate shall take as a maximum the flat Boston rate prescribed in the original order.

(b) Pig iron in carloads to other points in New England reached by the lines of the defendants shall take as maxima rates built by adding to the Boston rate the arbitraries or differentials employed immediately prior to June 9, 1914, to make the rates to such points.

(c) Pig iron in carloads to points north of Harrisburg on the branch of the Pennsylvania Railroad running through Williamsport to Sodus Point shall carry as maxima rates differentially adjusted to the Harrisburg rate which will be instituted as the result of our order hereunder and the findings and previous orders incorporated in it, so that the excess, if any, which existed immediately prior to June 9, 1914, in the rates to these points over the Harrisburg rate shall be the excess in the rate hereafter to such points.

(d) Pig iron in cardoads to points on Long Island shall, where the haul is all rail, take a maximum rate bearing the same relation in cents per gross ton to the rate from the Virginia furnaces to New York that the rate from Pittsburgh to the same point or points on Long Island bears to the rate from Pittsburgh to New York.

(e) To other points exclusive of those covered in (a), (b), (c), (d), supra, and those excluded as lying north of the main line of the Pennsylvania Railroad and west of the line of the Pennsylvania Railroad from Harrisburg through Williamsport to Sodus Point, and exclusive of those points, if any, not basing on Philadelphia, New York, or Baltimore, maximum rates on pig iron in carloads, shall be constructed such that, if identical with the rate to any one of the three basing points immediately prior to June 9, 1914, the rate in future shall be identical with the rate to said basing point; and such that if made by a differential under or over the rate to one of said basing points immediately prior to June 9, 1914, the future rate shall similarly be made by an identical differential under or over the rate to said basing point.

We are of the opinion and find that the defendants, the Central Railroad Company of New Jersey, the Lehigh Valley Railroad Company, and the Erie Railroad Company, jointly with the initial lines, should apply from the Virginia furnaces to New York rates on pig iron not to exceed $3 per gross ton.

Similarly as regards all defendants hereto in so far as they do or may participate in transporting pig iron from said Virginia furnaces to the four terminal points, or to related points, we find and determine that they shall establish as maximum rates to Boston, New York, Philadelphia, and Baltimore the rates prescribed in the original report with rates to related points differentially adjusted in accordance with the findings above outlined.

No claim for reparation was made at the time of the filing of the original complaint, but such a claim was subsequently presented along with the supplemental petition, to which were made defendant a number of carriers not parties to the original complaint. The readjustment of the pig-iron rates virtually extended to the Virginia furnaces the benefit, in considerable degree, of a scheme of rates enjoyed by the Pittsburgh furnaces, which was constructed originally with respect to the general base rate from Chicago to New York; and this readjustment was primarily to remedy the undue disadvantage under which the Virginia furnaces labored. Under the circumstances the commission declines to award further reparation.

W. L. C.

STEEL CORPORATION EARNINGS

Surplus for September Quarter $18,037,241

The United States Steel Corporation has issued its statement of earnings, covering its subsidiary companies, for the quarter ended Sept. 30, 1915. Only twice in seven years has it been surpassed. It compares as follows with the corresponding quarter of 1914:

	1915	1914
July earnings	$12,048,218	$7,475,993
August earnings	12,869,099	7,584,926
September earnings	13,793,327	7,215,083
Total earnings after deducting all expenses incident to operations, including those for ordinary repairs and maintenance of plants and interest on bonds of subsidiary companies	38,710,644	22,276,002
Less charges and allowances for depreciation, viz.:		
Sinking funds on bonds of subsidiary companies and depreciation and extraordinary replacement funds	7,028,034	6,017,922
Sinking funds on U. S. Steel Corporation bonds	1,636,819	1,576,058
Net income	30,045,791	14,682,022
Deduct interest for the quarter on U. S. Steel Corporation bonds outstanding and premium payable on bonds redeemable under sinking funds	5,703,631	5,746,111
Balance	24,342,160	8,935,911
Dividends for the quarter on stocks of the U. S. Steel Corporation, viz:		
Preferred	6,304,919	6,304,919
Common	.....	2,541,513
Surplus for the quarter	$18,037,241	$89,479

The dividend on the common stock has again been passed. A year ago the quarterly dividend on the common was reduced from 1¼ per cent to ½ of 1 per cent.

The earnings for the quarter ended June 30, 1915, were $27,950,055, and for the quarter ended March 31, 1915, were $12,457,809. The third quarter shows a gain over the second quarter of $10,760,589.

The total earnings for the nine months ended Sept. 30, 1915, were $79,118,508, and the surplus for that period was $20,915,025, against total earnings of $60,727,979 and a deficit, after the payment of dividends, of $11,359,402 for the nine months ended September 30, 1914.

Large Decrease in Indian Manganese-Ore Exports

Manganese-ore exports from India for July, 1915, were only 22,000 tons, as compared with 58,102 tons in July, 1914. All went to Great Britain, while of the exports in July, 1914, Great Britain received 26,377 tons; Belgium, 10,850 tons; France, 3100 tons, and the United States, 17,775 tons. Up to Aug. 1 no Indian manganese ore had been exported to the United States this year. Official statistics also show that for four months, April to July this year, the exports from India were only 78,072 tons against 245,086 tons in the same period in 1914. Of these exports this year 69,122 tons went to Great Britain, 4000 tons to France and 4950 tons to Italy.

Spanish exports of iron ore for the first half of 1915 were only 2,161,930 tons, as compared with 3,745,509 tons in the first half of 1914. Manganese-ore exports were 4534 tons to July 1, 1915, against 6459 tons to July 1, 1914. Pig-iron exports were 53,031 tons in the first six months of this year as compared with only 6426 tons in the same period of 1914.

The manganese-ore output of India in 1913, according to recent official data of the Geological Survey of India, was 815,047 gross tons. The iron-ore production was 370,845 tons and copper ore 3810 tons. The Indian magnesite output in 1913 was 14,086 tons.

All supplies of tungsten and molybdenite ores in Australia have been requisitioned by the Minister of Defense. A maximum price of 55s. and 105s. per unit of contained metal for tungsten and molybdenum ores respectively has been fixed.

CONTENTS

Locomotive Orders Increasing

Orders for about 80 locomotives are reported in the last week. The Illinois Central has contracted with the Lima Locomotive Corporation for 47 and with the American Locomotive Company for 3. The Lima Locomotive Corporation will also build 12 (8 Mikado and 4 Pacific) locomotives for the Central of Georgia. The Baldwin Locomotive Works has contracted to build 4 locomotives for the New Orleans & Northeastern and 10 for the Lehigh Valley, for which road it will also repair 20 locomotives and equip them with superheaters. The American Locomotive Company will furnish the Michigan Central with 7 locomotives. Single orders for one and two locomotives each make up the remainder.

New inquiries amount to 44, which may develop into 84. The Atchison, Topeka & Santa Fe is asking for bids on 30 Mikado locomotives and may increase this to 70 for all types. The Arthur Iron Mining Company is inquiring for 8 locomotives and the Michigan Central for 6.

Record Prices for Manganese Ore in Great Britain

Manganese ore is selling at the highest prices in years in Great Britain. Official quotations in the *London Iron and Coal Trades Review* on Sept. 24 placed 50 per cent Brazilian ore at 2s. 9d. (66c.) per unit, on Oct. 1 3s. 9d. (85c.) per unit, and on Oct. 8 3s. (73c.) per unit. The Indian ore on those dates was quoted at 1s. 8d. (40c.) and 1s. 7d. (38c.) per unit, depending on whether it was delivered on the west or east coast.

A third 12,000-ton boat, a duplicate of those recently ordered by the Pittsburgh Steamship Company, has been placed with the American Shipbuilding Company by the Interstate Steamship Company. It is to be ready for delivery at the opening of navigation next year. The Toledo Shipbuilding Company, Toledo, Ohio, has taken a contract to build two more ships for Atlantic coast trade. These will be constructed for the Smith Shipping Company, New York, which recently gave the same builder a contract for three boats.

The Iron and Metal Markets

STEEL MILLS FLOODED

Overflow Going in Unusual Channels

With the Greatest Production Ever Attained, Deliveries Fall Far Behind

Despite efforts of the larger steel companies to hold the demand in check, signs of a runaway steel market are increasing. They report orders coming in at such an enormous rate that all of them are being carefully considered before being accepted. On some classes of material it is a question of getting deliveries, and not prices. This month will establish new records in the output of iron and steel, but in spite of the huge production the mills are getting farther back in deliveries.

The extraordinary demand for open-hearth steel is bringing about movements which prevailed several years ago under similar conditions. Foundries having open-hearth furnaces are taking contracts for forging billets, arranging to have steel ingots bloomed by steel companies having excess capacity in blooming mills.

An interesting sale is 15,000 tons of Bessemer sheet bars to a southern Ohio sheet mill which has an open-hearth plant. This is due to the fact that the latter has been able to sell its open-hearth steel at such profitable prices that it will use the purchased Bessemer bars to make sheets. The Carnegie Steel Company is preparing to start its plant at Columbus, Ohio, which has two 300-ton blast furnaces and a 500-ton Bessemer steel department. This plant has been idle for a number of years and is only operated when the pressure for steel becomes very strong.

Barb wire, steel rounds, forging billets, blooms and wire rods are conspicuous in the export demand and over $40 per ton has been paid for wire rods. Better than $50 has been paid for forging blooms and one inquiry alone, for France, is for 100,000 tons.

In the past week steel bars, shapes and plates advanced $1 per ton, sheets $2, hoops $5, railroad spikes $2, shafting $2, cold rolled strip steel $3, bands $1, billets $1, sheet bars $1.50 and prompt furnace coke 50c. to 75c. Bar iron at Chicago was marked up $2 per ton.

The pig-iron market is very strong and prices are not only maintained but are being advanced in some districts. Several furnace interests have withdrawn completely from the market for delivery this year and some have stated their inability to consider orders on foundry iron until next July.

The selling of pig iron at Chicago continues so actively and in such volume that the furnaces have been easily able to maintain their maximum basis of prices and the situation there is rapidly approaching a condition of maximum production. It is expected that by January there will be inactive in the Chicago district only two furnaces of comparatively small capacity which are not expected to be able to operate before the opening of navigation next spring.

The effect of the interruption of navigation through the Panama Canal is shown by the report from Cleveland that the Bethlehem Steel Company entered the market last week for 50,000 tons of Lake Superior iron ore for this season's delivery, but its efforts were apparently unsuccessful, as boats could not be had to bring the ore from the upper Lake shipping docks to lower Lake ports.

Large contracts have been placed for fabricated material, including considerable bridge work for various railroad companies. Some manufacturing consumers of finished steel have forearmed in putting through specifications for quantities formerly of contract size. Thus they do not exact protection, which some sellers are loath to give for next year, and yet fear no embarrassment through the receipt of material in excess of needs.

The demand for plates for shipbuilding is heavy. The past week has witnessed the placing of a number of contracts for vessels to be built on the Great Lakes, on the Atlantic seaboard and on the Pacific coast, which require an aggregate of probably 25,000 tons of plates and shapes. Announcement of further buying of ships on the Atlantic seaboard may be expected in a few days.

The tin-plate manufacturers have not yet announced their price for 1916 delivery and this may not be done before December because of the scarcity of steel and undoubtedly higher prices for sheet bars which naturally induce caution in naming prices for the finished product extending so far into the future.

Consumers of coke who have delayed covering their requirements are paying the penalty, as coke prices have advanced sharply the past week.

A Comparison of Prices

Advances Over the Previous Week in Heavy Type. Declines in Italics

At date, one week, one month and one year previous

	Oct. 27, 1915.	Oct. 20, 1915.	Sept. 29, 1915.	Oct. 28, 1914.
Pig Iron, Per Gross Ton:				
No. 2, X, Philadelphia...	$16.25	$16.25	$16.25	$14.50
No. 2, Valley furnace....	15.00	15.00	14.75	12.75
No. 2 Southern, Cin'ti...	**15.40**	14.90	14.40	12.90
No. 2, Birmingham, Ala.	**12.50**	12.00	11.50	10.00
No. 2, furnace, Chicago*	**15.25**	14.75	14.25	12.75
Basic, del'd, eastern Pa.	17.00	17.00	17.00	14.00
Basic, Valley furnace...	15.00	15.00	15.00	12.50
Bessemer, Pittsburgh....	16.95	16.95	16.95	14.65
Malleable Bess., Ch'go*.	15.50	15.50	15.00	13.00
Gray forge, Pittsburgh...	14.70	14.70	14.70	13.40
L. S. charcoal, Chicago...	15.75	15.75	15.75	15.75
Billets, etc. Per Gross Ton:				
Bess. billets, Pittsburgh.	**25.00**	24.50	24.50	19.50
O.-h. billets, Pittsburgh.	**26.00**	25.00	25.00	19.50
O.-h. sheet bars, P'gh...	**27.00**	25.50	25.50	20.00
Forging billets, base, P'gh	**40.00**	34.50	33.00	25.00
O.-h. billets, Phila.....	**32.00**	32.00	30.00	22.40
Wire rods, Pittsburgh...	**33.00**	32.00	30.00	25.50
Finished Iron and Steel,				
Per Lb. to Large Buyers:	Cents.	Cents.	Cents.	Cents.
Bess. rails, heavy, at mill	1.25	1.25	1.25	1.25
Iron bars, Philadelphia..	1.559	1.559	1.509	1.12
Iron bars, Pittsburgh...	**1.45**	1.40	1.35	1.15
Iron bars, Chicago.....	**1.45**	1.35	1.35	0.97½
Steel bars, Pittsburgh...	**1.50**	1.45	1.35	1.15
Steel bars, New York..	**1.669**	1.619	1.569	1.31
Tank plates, Pittsburgh.	**1.50**	1.45	1.35	1.10
Tank plates, New York.	**1.669**	1.619	1.569	1.26
Beams, etc., Pittsburgh.	**1.50**	1.45	1.35	1.15
Beams, etc., New York.	**1.669**	1.619	1.569	1.31
Skelp, grooved steel, P'gh	**1.45**	1.40	1.35	1.15
Skelp, sheared steel, P'gh	**1.50**	1.45	1.40	1.20
Steel hoops, Pittsburgh..	**1.75**	1.50	1.40	1.25

*The average switching charge for delivery to foundries in the Chicago district is 50c. per ton.

	Oct. 27, 1915.	Oct. 20, 1915.	Sept. 29, 1915.	Oct. 28, 1914.
Sheets, Nails and Wire, Per Lb. to Large Buyers:	Cents.	Cents.	Cents.	Cents.
Sheets, black, No. 28, P'gh	**2.10**	2.00	1.90	1.90
Galv. sheets, No. 28, P'gh	**3.50**	3.50	3.50	2.90
Wire nails, Pittsburgh	1.85	1.85	1.75	1.60
Cut nails, Pittsburgh	**1.80**	1.70	1.60	1.60
Fence wire, base, P'gh	1.70	1.70	1.60	1.40
Barb wire, galv., P'gh	2.70	2.70	2.60	2.00
Old Material, Per Gross Ton:				
Iron rails, Chicago	**$13.50**	**$13.50**	**$13.50**	**$11.00**
Iron rails, Philadelphia	17.50	17.50	18.50	13.00
Carwheels, Chicago	12.00	12.00	12.00	10.50
Carwheels, Philadelphia	13.50	13.50	14.00	9.50
Heavy steel scrap, P'gh	**15.00**	14.50	14.25	10.50
Heavy steel scrap, Phila.	14.50	14.50	15.00	9.50
Heavy steel scrap, Ch'go	11.75	11.75	11.75	8.50
No. 1 cast, Pittsburgh	**13.50**	12.75	13.00	11.50
No. 1 cast, Philadelphia	14.00	14.00	14.00	11.00
No. 1 cast, Ch'go (net ton)	10.50	10.50	10.50	9.00
Coke, Connellsville, Per Net Ton at Oven:				
Furnace coke, prompt	**$2.50**	$2.00	$1.70	$1.60
Furnace coke, future	**2.35**	2.25	2.25	1.75
Foundry coke, prompt	**2.75**	2.25	2.15	2.00
Foundry coke, future	2.60	2.60	2.40	2.15
Metals,	Cents.	Cents.	Cents.	Cents.
Per Lb. to Large Buyers:				
Lake copper, New York	**17.87½**	17.75	18.00	11.50
Electrolytic copper, N. Y.	**17.87½**	17.75	18.00	11.25
Spelter, St. Louis	**14.00**	13.25	14.25	4.95
Spelter, New York	**14.25**	13.50	14.50	5.10
Lead, St. Louis	**4.62½**	4.42½	4.42½	3.37½
Lead, New York	**4.75**	4.50	4.50	3.50
Tin, New York	**33.50**	33.25	33.25	30.75
Antimony, Asiatic, N. Y.	**34.25**	29.00	28.00	14.00
Tin plate, 100-lb. box, P'gh	$3.15	$3.15	$3.15	$3.15

Finished Iron and Steel f. o. b. Pittsburgh

Freight rates from Pittsburgh in carloads, per 100 lb.: New York, 16.9c.; Philadelphia, 15.9c.; Boston, 18.9c.; Buffalo, 11.6c.; Cleveland, 10.5c.; Cincinnati, 15.8c.; Indianapolis, 17.9c.; Chicago, 18.9c.; St. Louis, 23.6c.; Kansas City, 43.6c.; Omaha, 43.6c.; St. Paul, 32.9c.; Denver, 68.6c.; New Orleans, 30c.; Birmingham, Ala., 45c.; Pacific coast, 73.9c. on plates, structural shapes and sheets and 65c. on wrought pipe and boiler tubes. The foregoing rates to the Pacific coast are by rail. The rate via New York and the Panama Canal is 56.9c.

Plates.—Tank plates, ¼ in. thick, 6¼ in. up to 100 in. wide, 1.50c., base, net cash, 30 days. Following are stipulations prescribed by manufacturers:

Rectangular plates, tank steel or conforming to manufacturers' standard specifications for structural steel dated Feb. 6, 1903, or equivalent, ¼ in. and over on thinnest edge, 100 in. wide and under, down to but not including 6 in. wide, are base.

Plates up to 72 in. wide, inclusive, ordered 10.2 lb. per sq. ft., are considered ¼-in. plates. Plates over 72 in. wide must be ordered ¼ in. thick on edge or not less than 11 lb. per sq. ft., to take base price. Plates over 72 in. wide ordered less than 11 lb. per sq. ft. down to the weight of 3-16 in. take the prices of 3-16 in.

Allowable overweight, whether plates are ordered to gage or weight to be governed by the standard specifications of the Association of American Steel Manufacturers.

Extras	Cents per lb.
Gages under ¼ in. to and including 3-16 in.	.10
Gages under 3-16 in. to and including No. 8	.15
Gages under No. 8 to and including No. 9	.25
Gages under No. 9 to and including No. 10	.30
Gages under No. 10 to and including No. 12	.40
Sketches (including straight taper plates), 3 ft. and over	.10
Complete circles, 3 ft. in diameter and over	.20
Boiler and flange steel	.10
"A. B. M. A." and ordinary firebox steel	.20
Still bottom steel	.30
Marine steel	.40
Locomotive firebox steel	.50
Widths over 100 in. up to 110 in., inclusive	.05
Widths over 110 in. up to 115 in., inclusive	.10
Widths over 115 in. up to 120 in., inclusive	.15
Widths over 120 in. up to 125 in., inclusive	.25
Widths over 125 in. up to 130 in., inclusive	.50
Widths over 130 in	1.00
Cutting to lengths under 3 ft. to 2 ft., inclusive	.25
Cutting to lengths under 2 ft. to 1 ft., inclusive	.50
Cutting to lengths under 1 ft	1.55

No charge for cutting rectangular plates to lengths 3 ft. and over.

Wire Products.—Prices to jobbers: Fence wire, Nos. 0 to 9, per 100 lb., terms sixty days or 2 per cent discount in ten days, carload lots, annealed, $1.70; galvanized, $2.40. Galvanized barb wire and staples, $2.70; painted, $2. Wire nails, $1.85. Galvanized nails, 1 in. and longer, $1.75 advance over base price; shorter than 1 in., $2.25 advance over base price. Woven wire fencing, 68½ per cent off list for carloads, 67½ off for 1000-rod lots, 66½ off for less than 1000-rod lots.

The following table gives the price per 100 lb. to retail merchants on fence wire in less than carloads, with the extras added to the base price:

Plain Wire, per 100 lb.

Nos.	0 to 9	10	11	12&12½	13	14	15	16
Annealed	$1.75	$1.80	$1.85	$1.90	$2.00	$2.10	$2.20	$2.30
Galvanized	2.65	2.70	2.75	2.80	2.90	3.00	3.30	3.40

Wire Rods.—Bessemer, open-hearth and chain rods, $33.

Structural Material.—I-beams, 3 to 15 in.; channels, 3 to 15 in.; angles, 3 to 6 in. on one or both legs, ¼ in. thick and over, and zees 3 in. and over, 1.50c. Extras on other shapes and sizes are as follows:

	Cents per lb.
I-beams over 15 in.	.10
H-beams over 18 in.	.10
Angles over 6 in., on one or both legs	.10
Angles, 3 in. on one or both legs less than ¼ in. thick, as per steel bar card, Sept. 1, 1909	.70
Tees, structural sizes (except elevator, handrail, car truck and conductor rail)	.05
Channels and tees, under 3 in. wide, as per steel bar card, Sept. 1, 1909	.20 to .80
Deck beams and bulb angles	.30
Handrail tees	.75
Cutting to lengths under 3 ft. to 2 ft. inclusive	.25
Cutting to lengths, under 2 ft. to 1 ft. inclusive	.50
Cutting to lengths, under 1 ft.	1.55

No charge for cutting to lengths 3 ft. and over.

Wrought Pipe.—The following are the jobbers' carload discounts on the Pittsburgh basing card in effect from Aug. 16, 1915, all full weight:

Butt Weld

Steel			Iron		
Inches	Black	Galv.	Inches	Black	Galv.
⅛, ¼ and ⅜	72	46½	⅛ and ¼	64	37
½	76	59½	⅜	64	37
¾ to 3	79	63½	½	68	47
			¾ to 2½	71	52

Lap Weld

2	76	60½	1¼	55	36
2½ to 6	78	62½	1½	66	47
7 to 12	76	58½	2	67	49
13 and 14	62½	..	2½ to 4	69	52
15	60	..	4½ to 6	69	52
			7 to 12	67	50

Reamed and Drifted

1 to 3, butt	77	61½	1 to 1½, butt	69	50
2, lap	74	58½	2, butt	69	50
2½ to 6, lap	76	60½	1¼, lap	53	34
			1½, lap	64	45
			2, lap	65	47
			2½ to 4, lap	67	50

Butt Weld, extra strong, plain ends

⅛, ¼ and ⅜	67	49½	⅜	61	43
½	72	58½	½	66	51
¾ to 1½	76	62½	¾ to 1½	70	53
2 to 3	77	63½	2 and 2½	71	54

Lap Weld, extra strong, plain ends

2	73	57½	1½	65	48
2½ to 4	75	59½	2	67	49
4½ to 6	74	58½	2½ to 4	69	52
7 to 8	68	50½	4½ to 6	68	51
9 to 12	63	45½	7 to 8	61	44
			9 to 12	56	39

Butt Weld, double extra strong, plain ends

½	62	48½	½	56	40
¾ to 1½	65	51½	¾ to 1½	59	43
2 to 2½	67	53½	2 and 2½	61	45

Lap Weld, double extra strong, plain ends

2	63	49½	2	57	40
2½ to 4	65	51½	2½ to 4	59	45
4½ to 6	64	50½	4½ to 6	58	44
7 to 8	58	40½	7 to 8	51	33

To the large jobbing trade an additional 5 per cent is allowed over the above discounts.

The above discounts are subject to the usual variation in weight of 5 per cent. Prices for less than carloads are two (2) points lower basing (higher price) than the above discounts on black and three (3) points on galvanized.

Boiler Tubes.—Discounts on less than carloads, f.o.b. Pittsburgh, freight to destination added, on lap welded steel tubes and standard charcoal iron tubes, effective from Oct. 1, 1915, are as follows:

Lap Welded Steel		*Standard Charcoal Iron*	
1½ in.	50	1½ in.	45
1¾ and 2 in.	62	1¾ and 2 in.	49
2¼ in.	59	2¼ in.	46
2½ and 2¾ in.	65	2½ and 2¾ in.	53
3 and 3½ in.	70	3 and 3½ in.	57
3½ to 4½ in.	71	3½ to 4½ in.	59
5 and 6 in.	64	5 and 6 in.	53
7 to 13 in.	61		

Locomotive and steamship special charcoal grades bring higher prices.

1¾ in., over 18 ft., 10 per cent net extra.

2 in. and larger, over 22 ft., 10 per cent net extra.

Sheets.—Makers' prices for mill shipment on sheets of U. S. Standard gage, in carload and larger lots, on which jobbers charge the usual advance for small lots from store, are as follows, f.o.b. Pittsburgh, terms thirty days net, or 2 per cent cash discount in ten days from date of invoice:

Blue Annealed Sheets

	Cents per lb.
Nos. 3 to 8	1.55 to 1.65
Nos. 9 to 10	1.60 to 1.70
Nos. 11 and 12	1.65 to 1.75
Nos. 13 and 14	1.70 to 1.80
Nos. 15 and 16	1.80 to 1.90

Box Annealed Sheets, Cold Rolled

	Cents per lb.
Nos. 10 and 11	1.75 to 1.85
No. 12	1.75 to 1.85
Nos. 13 and 14	1.80 to 1.90
Nos. 15 and 16	1.85 to 1.95
Nos. 17 to 21	1.90 to 2.00
Nos. 22 and 24	1.95 to 2.05
Nos. 25 and 26	2.00 to 2.10
No. 27	2.05 to 2.15
No. 28	2.10 to 2.20
No. 29	2.15 to 2.25
No. 30	2.25 to 2.35

Galvanized Sheets of Black Sheet Gage

	Cents per lb.
Nos. 10 and 11	2.50 to 2.65
No. 12	2.60 to 2.75
Nos. 13 and 14	2.60 to 2.75
Nos. 15 and 16	2.70 to 2.85
Nos. 17 to 21	2.85 to 3.00
Nos. 22 and 24	3.05 to 3.20
Nos. 25 and 26	3.20 to 3.35
No. 27	3.35 to 3.50
No. 28	3.50 to 3.65
No. 29	3.65 to 3.75

Pittsburgh

PITTSBURGH, PA., Oct. 26, 1915.

Signs of a runaway steel market are increasing, in spite of efforts of the large interests to hold the market in check. Leading steel companies report orders coming in at an enormous rate, but all are being carefully considered before acceptance. On some lines of material it is a question of getting deliveries, and not of prices. In the past week bars, plates and shapes advanced $1 per ton; sheets about $2, cold-rolled strip steel $3, railroad spikes $2, hoops $5, bands $1, shafting $2, and prompt furnace coke 50c. to 75c. Forging billets have sold at $40 and higher for ordinary carbons. Some grades of steel scrap used in open-hearth practice, notably locomotive and steel car axles, are up from $1.50 to $2 per ton. The Carnegie Steel Company has issued orders to start its plant at Columbus, Ohio, which has two 300-ton blast furnaces and a 500-ton Bessemer steel plant. The blast furnaces are expected to be going early in November, and the steel plant a week or so later. Large inquiries are in the market for steel cars, and others are about ready to come out. October will establish some new records in iron and steel output, but, in spite of this, the mills are getting farther back in deliveries. Export inquiry for barb wire, steel rounds and forging billets continues extraordinarily heavy.

Pig Iron.—The Brier Hill Steel Company, Youngstown, Ohio, has sold 4000 tons and a local furnace interest 2500 tons of standard Bessemer iron for shipment to Italy, both sales having been made at $16, Valley furnace. We also note a sale of 1000 tons of Bessemer iron for delivery to a steel casting concern in Detroit, in the first four months of next year, at $16, Valley furnace. Some inquiries from sources that do not ordinarily buy pig iron in the valleys have lately come out. Southern Ohio steel companies are each figuring on about 6000 tons of basic iron, one for this year's delivery and the other for second quarter. A large local consumer has bought 20,000 tons of standard Bessemer iron for delivery up to June of next year. A small part of the purchase was at less than $16, Valley furnace, some of it at $16, and 5000 tons at $16.25, the purchase averaging about $16 at makers' furnaces. We quote standard Bessemer iron, $16; basic, $15; malleable Bessemer, $14.75 to $15; gray forge, $13.75 to $14, and No. 2 foundry, $15, all at Valley furnace, the freight for delivery in the Cleveland or Pittsburgh district being 95c. per ton.

Billets and Sheet Bars.—Very high prices have been paid the past week for forging billets, $40 having been done on ordinary carbon, and as high as $48 on high carbon. We note a sale of 300 tons of ordinary carbon forging billets at $39.50, Pittsburgh, but it is doubtful if any more could be obtained at this price. We also note a sale of 15,000 tons of Bessemer sheet bars by the Carnegie Steel Company to go to Portsmouth, Ohio, equal deliveries in January, February and March at $28, maker's mill. These sheet bars will be shipped from the Columbus works of the Carnegie Company. The buyer has an open-hearth plant, but has been able to sell its open-hearth steel at such profitable prices that it intends to replace some of the open-hearth steel with Bessemer. A leading steel interest is taking care of its customers for the remainder of this year on the basis of $24 for Bessemer and $25 for open-hearth sheet bars, f.o.b. mill. A local engineering company that has several small open-hearth furnaces in one of its plants has sold 5000 tons of forging billets at $40 per ton at maker's works. The seller has no blooming mill, but sends the ingots to a steel plant that has some excess blooming capacity. Prices have been advanced and we now quote: Bessemer billets, $25; open-hearth billets, $26; Bessemer sheet bars, $26, and open-hearth sheet bars, $27, maker's mill, Youngstown or Pittsburgh, prices of steel at the two points named being about the same. Higher prices have been paid for open-hearth billets and sheet bars for prompt delivery, and probably $1 to $2 per ton advance would be quoted for first quarter of next year. We quote forging billets at $40 to $41 for sizes up to but not including 10 x 10 in., and for carbons up to 0.25, the regular extras being charged for larger sizes and higher carbons. Forging billets running above 0.25 and up to 0.60 carbon take $1 per ton extra. Axle billets are held at $31 to $32.

Ferroalloys.—Several fairly large cargoes of English 80 per cent ferromanganese have lately arrived in this country. The situation as regards supply is therefore a good deal better, and prices are easier. English 80 per cent ferromanganese is now being offered at $97.50 to $100, seaboard, the freight from Baltimore to Pittsburgh delivery points being $2.30 per ton. The larger supply of foreign has resulted in prices of domestic easing off, and we now quote domestic 80 per cent at about $100 at furnace, equal to about $101, delivered Pittsburgh. We quote, nominally, 50 per cent ferrosilicon in lots up to 100 tons at $73; over 300 tons to 600 tons, $72, and over 600 tons, $71, delivered in the Pittsburgh district. No price has yet been fixed on 50 per cent ferrosilicon for delivery next year. We quote Bessemer ferrosilicon as follows: 9 to 10 per cent, $22; 10 to 11, $23; 11 to 12, $24; 12 to 13, $25; 14 per cent, $26.50; 15 per cent, $28.50, and 16 per cent, $31. These prices are f.o.b. furnace, Ashland, Ky., Jackson, Ohio, or New Straitsville, Ohio, each of these points having a freight rate of $2 per gross ton to Pittsburgh. These prices are for delivery over the remainder of this year only. For delivery in first quarter of 1916, 50c. per ton higher is quoted. We quote ferrotitanium at 8c. per pound in carloads, 10c. in 2000-lb. lots and over, and 12½c. in smaller lots; ferrovanadium, $2.25 to $2.50 per pound of contained vanadium, prices depending on the size of the order.

Steel Rails.—No large orders for standard sections have been taken recently by the local interest, but some orders for export for fairly large amounts have recently been placed. The new demand for light rails is very active, the coal mining and lumber interests buying freely. The Carnegie Steel Company received new orders and specifications in the past week for over 4000 tons. We quote standard section rails of Bessemer stock at 1.25c., and of open-hearth stock, 1.34c., f.o.b. Pittsburgh. We quote light rails as follows: 25 to 45-lb. sections, 1.34c.; 16 and 20 lb., 1.39c., 12 and 14 lb., 1.44c.; 8 and 10 lb., 1.49c., in carload or larger lots, 5c. per 100 lb. advance being charged for less than carload lots.

Structural Material.—New inquiry is very active and some large jobs have been placed. The McClintic-Marshall Company has taken about 25,000 tons for extensions to the elevated lines in Philadelphia; the American Bridge Company, 600 tons of bridge work for the Pennsylvania Railroad, 3000 to 3500 tons of bridge work for the Charleston & Southern Railway.

and about 1000 tons for industrial plants to be built in the South, for which the Pratt Engineering Company, Atlanta, Ga., is engineer; the John Eichleay, Jr., Company, 600 tons for the new Tod House, Youngstown, Ohio, and 700 tons for an addition to the Hollenden Hotel, Cleveland. The leading steel companies are now quoting 1.50c., minimum, on shapes. We quote beams and channels up to 15 in. at 1.50c., f.o.b. Pittsburgh, for delivery this year and first quarter of 1916.

Plates.—The Carnegie Steel Company has taken about 5000 tons of plates and shapes for each of two boats to be built for the Pittsburgh Steamship Company, and 900 tons of steel plates for each of four schooners to be built by the Toledo Shipbuilding Company for ocean trade. The Union Iron Works, San Francisco, has taken three boats for the Japan trade, and has inquiries out for 3500 tons of plates and shapes for each boat. The New York Central has an inquiry out for 1000 steel cars, but it is believed that it may buy upward of 10,000 cars. Other roads are in the market, and it is said that inquiries are now out, or will be shortly, for 50,000 to 60,000 cars. The Pressed Steel Car Company has taken fifty 50-ton steel hoppers for the Michigan Alkali Company, Wyandotte, Mich., and fifty steel ore cars for Phelps, Dodge & Co. All the plate mills are now quoting 1.50c. on plates. The two leading local plate mills are said to be well filled through the first quarter of next year. We quote ¼-in. and heavier plates at 1.50c., f.o.b. Pittsburgh.

Carwheels.—Some large inquiries for carwheels are in the market from railroads that have lately placed orders for steel cars. Prices are very strong and likely to be higher. We quote 33-in. freight carwheels at $17; 33-in. tender wheels, $20; 36-in. passenger or tender wheels, $24. These prices are based on a 10-in. diameter hub, 50c. extra being charged for an 11-in. diameter hub, all f.o.b. Pittsburgh.

Sheets.—The minimum on Bessemer black No. 28 sheets now seems to be 2.10c., and several of the larger mills say they are holding for 2.20c. Reports are that the largest contract for blue annealed sheets ever made for export has about been closed. The new demand for Bessemer black and blue annealed sheets is heavy, and several of the leading mills say that specifications since Sept. 1 on blue annealed and black sheets have been in excess of output. The demand for galvanized sheets is getting heavier. The American Sheet & Tin Plate Company, in opening its books for the first quarter, places No. 10 blue annealed at 1.80c., Pittsburgh; No. 28 Bessemer black sheets, 2.25c., and No. 28 galvanized sheets, 3.65c. For prompt blue annealed sheets, its quotation is 1.70c. for Nos. 9 and 10. We quote No. 28 galvanized sheets at 3.50c. to 3.65c.; No. 28 Bessemer black sheets, 2.10c. to 2.20c.; Nos. 9 and 10 blue annealed, 1.60c.; No. 30 black plate, tin-mill sizes, H. R. & A., 1.95c.; No. 28, 1.90c.; Nos. 27, 26 and 25, 1.85c.; Nos. 22 and 24, 1.80c.; Nos. 17 to 21, 1.75c.; Nos. 15 and 16, 1.70c. The above prices are for carload lots, f.o.b. at maker's mill.

Tin Plate.—Specifications against contracts continue heavy, and mills are running to practically full capacity. Some consumers who desired to cover into January have placed several contracts at $3.10, while for first quarter some contracts have been made at $3.25 per base box. With the scarcity of steel and the higher prices for sheet bars that are certain to rule, makers of tin plate will go slow before announcing a price for next year, and this may not be done before December. We quote 14 x 20 coke plates for domestic trade at $3.10 to $3.25 for delivery over the next two or three months.

Railroad Spikes.—Owing to the heavy inquiry and the fact that makers of spikes can put the steel into other forms of material that will pay better prices, spikes have again been advanced $2 per ton, and mills are now quoting $1.70 per 100 lb. for delivery through first quarter of 1916 and $1.80 for second quarter. We quote small railroad and boat spikes at $1.80 for delivery into first quarter and $1.90 for second quarter, per 100 lb., f.o.b., Pittsburgh.

Cold-Rolled Strip Steel.—Owing to the heavy demand and the fact that the mills making cold-rolled strip steel have very little to sell, prices have again advanced and it is now being held at $3.25 base. It is said that premiums are being paid for prompt delivery. We quote hard-rolled steel, 1½ in. and wider, under 0.20 carbon, sheared or natural mill edge, per 100 lb., $3.25 delivered. Extras, which are standard among all mills, are as follows:

Thickness, in.	Extras for thickness	Extras for soft or intermediate tempers	Extras for straightening and cutting to lengths not less than 24 in.
0.100 and heavier	Base	$0.25	$0.10
0.099 to 0.050	$0.05	0.25	0.15
0.049 to 0.035	0.20	0.25	0.15
0.034 to 0.031	0.35	0.40	0.25
0.030 to 0.025	0.45	0.40	0.40
0.024 to 0.020	0.55	0.40	0.50
0.019 to 0.017	0.85	0.50	1.10
0.016 to 0.015	1.25	0.50	1.10
0.014 to 0.013	1.95	0.50	1.25
0.012	2.30	0.50	coils only
0.011	2.65	0.50	coils only
0.010	3.00	0.50	coils only

Skelp.—There is not much demand, but prices are very firm. Some mills that ordinarily roll skelp are now putting the steel into other forms of products, for which they can get better prices. Higher prices are being asked and we now quote: Grooved steel skelp, 1.50c. to 1.55c.; sheared steel skelp, 1.55c. to 1.60c.; grooved iron skelp, 1.90c. to 1.95c., and sheared iron skelp, 2c. to 2.05c., all delivered to consumers' mills in the Pittsburgh district.

Wire Rods.—It is not a question now of prices, but where to get rods for reasonably prompt delivery. A leading interest is said to have sold 20,000 tons for shipment to Canada in first quarter of next year at $35 per ton, f.o.b. maker's mill. It is also stated that the Colorado interest sold 35,000 tons of rods for export to Europe during the next four to six months at about the same price. We quote Bessemer, open-hearth and chain rods at $33 to $34, maker's mill.

Wire Products.—All the mills are now quoting the higher prices on wire products that went into effect on Thursday, Oct. 21. Specifications against contracts for wire nails at the $1.65 and $1.75 price are coming in freely, and the mills state these contracts will be cleaned up in a short time. This is also true of contracts for wire placed at lower prices. The wire mills are swamped with business and are turning down more orders than they are accepting. Export inquiry is enormously heavy. One inquiry is in the market for 40,000 tons of barb wire for delivery to Russia, another is for 9000 tons of galvanized steel telegraph wire, and another for 5000 tons of copper wire. We quote: Wire nails, $1.85; galvanized nails 1 in. and longer taking an advance over this price of $1.75, and shorter than 1 in., $2.25; plain annealed wire, $1.70; galvanized barb wire and fence staples, $2.70; painted barb wire, $2; polished fence staples, $2, all f.o.b. Pittsburgh, with freight added to point of delivery, terms sixty days net, less 2 per cent off for cash in ten days. Prices on woven wire fencing are 68½ per cent off list for carload lots, 67½ per cent for 1000-rod lots, and 66½ per cent for small lots, f.o.b. Pittsburgh.

Rivets.—New demand continues heavy and rivet makers are filled up for some months and are back in deliveries. Foreign demand is very active. Higher prices are likely, owing to the scarcity of steel and the active market. We quote buttonhead structural rivets at $1.90 and conehead boiler rivets at $2 in carload lots, per 100 lb., f.o.b. Pittsburgh, smaller lots bringing about 10c. advance, and for delivery this year only.

Hoops and Bands.—Effective Monday, Oct. 25, prices on bands were advanced to 1.50c., and the following day hoops were advanced to 1.75c. The demand is abnormally heavy. Specifications against contracts are coming in very freely. We now quote steel hoops at 1.75c. and steel bands at 1.50c., f.o.b. Pittsburgh, with extras on the latter as per the steel bar card.

Iron and Steel Bars.—The demand for steel bars is away beyond the capacity of the mills to supply, and on some sizes they are back in orders from 8 to 10 weeks. Effective Monday, Oct. 25, prices on steel bars were advanced to 1.50c., and contracts have been made for deliveries running through first quarter at this price. The demand for steel rounds for shrapnel continues heavy, but not much of this business is coming

to local mills, as they cannot take care of it. October will show a record output in steel bars and also in shipments. We now quote steel bars at 1.50c. for delivery through first quarter. Common iron bars are very firm at 1.40c. to 1.45c.; refined iron bars, 1.55c. to 1.60c., and railroad test bars, 1.60c. to 1.65c., f.o.b. Pittsburgh.

Shafting.—Prices on shafting have again been advanced $2 per ton. It is not a question of price, but where consumers can get the material. Local shafting makers say they are filled up for six months or more ahead. There has never been a time in the history of the shafting trade when orders were so active as they are now. We quote cold-rolled shafting at 58 per cent off in carloads and 53 per cent in less than carloads, f.o.b., Pittsburgh. Premiums over regular prices would be readily paid for prompt deliveries.

Merchant Steel.—Orders are beyond the capacity of the mills to supply and shipments are delayed from six to eight weeks. At this writing small lots are as follows: Iron finished tire, ½ x 1½ in. and larger, 1.70c. base; under ½ x 1½ in., 1.85c.; planished tire, 1.90c.; channel tire, ¾ to ⅞ and 1 in., 2.20c. to 2.30c.; 1 x ⅛ in. and larger, 2.30c.; toe calk, 2.30c. to 2.40c., base; flat sleigh shoe, 2.05c.; concave and convex, 2.10c.; cutter shoe, tapered or bent, 2.60c. to 2.70c.; spring steel, 2.30c. to 2.40c.; machinery steel, smooth finish, 2.10c.

Nuts and Bolts.—Makers of nuts and bolts report a demand beyond their capacity to supply. Prices are very strong and likely to be higher. Discounts in effect at this writing are as follows: Common carriage bolts, ⅜ x 6 in., and shorter and smaller, rolled thread, 70, 10 & 10; cut thread, 75, 10 & 5; larger or longer, 75 & 5. Machine bolts with h. p. nuts, ⅜ x 4 in., and shorter and smaller, rolled thread, 75 & 5; cut thread, 75, 10 & 5; larger or longer, 75 & 10. Machine bolts with c. p. c. t. and r. nuts, ⅜ x 4 in., and shorter and smaller, 75, 10 & 2½; larger or longer, 70, 10 & 7½. Blank bolts, 75 & 10. Bolt ends with h. p. nuts, 75 & 10; with c. p. c. and t. nuts, 70, 10 & 7½. Lag screws (cone or gimlet point), 80 & 15. Square nuts, h. p., tapped or blank, $6 off list; hexagon, $6.70 off; c. p. c. t. and r. nuts, tapped or blank, square, $5.50 off; hexagon, ⅝ in. and larger, $7 off; smaller, $7.50 off; semi-finished nuts, ⅝ in. and larger, 85 & 10; smaller, 85, 10 & 10. Rivets, smaller than ½ in. in diameter, 80 & 10. All the foregoing prices are f.o.b. Pittsburgh, subject to an actual freight allowance not to exceed 20c. per 100 lb. on shipments of 300 lb. or more.

Wrought Pipe.—Mills report the new demand for merchant pipe a good deal better, being now close to 65 to 75 per cent of capacity of the mills. Prices are firm, and on account of the increasing scarcity and the higher market on steel it is anticipated there may be an advance on both iron and steel pipe in the near future.

Boiler Tubes.—The new demand for boiler tubes is quite active and for merchant tubes is also heavier than for a long time. Some large contracts for locomotive tubes have lately been placed, deliveries running into first quarter and first half. Discounts are reported as firmly held.

Coke.—The flurry of the past week in the price of prompt furnace coke was caused by the Republic Iron & Steel Company coming in the market for thirty to forty cars per day, buying at prices ranging from $2.50 to $2.75 per net ton at oven. There was some delay in getting its by-product ovens started, so that it has had to buy coke to fill out. There were no other large buyers of prompt coke in the market, and the price is expected to recede; in fact, standard prompt furnace coke is offering to-day at $2.60 or less. The Pittsburgh Steel Company has an inquiry out for 18,000 to 20,000 tons of furnace coke for delivery in last half of 1916. Several more contracts have been made on a sliding scale basis, which on the present price of basic iron would net the coke producers $2.15 to $2.25 per net ton at oven. Pickands, Mather & Co. are understood to have bought from the leading Connellsville interest coke for one Toledo furnace for first three months of 1916, also for Perry furnace at Erie, and Ella at West Middlesex, Pa., for first half of 1916 at about $2.25 per net ton at oven. Negotiations are on with three or four furnace companies for first half and all of 1916. We quote standard makes of furnace coke for prompt shipment at $2.50 to $2.60; for first half of 1916, $2.35 to $2.40, and for all of 1916, $2.25 per net ton at oven. Prices on 72-hr. foundry coke are higher and it is held at $2.75 for prompt shipment and $2.60 to $2.75 on contracts for first half of 1916 for the very best grades. The Connellsville *Courier* gives the output of coke in the upper and lower Connellsville regions for the week ended Oct. 16, as 421,091 net tons, an increase over the previous week of 4367 tons.

Old Material.—There has been a sharp advance on nearly all grades of steel scrap, particularly iron and steel axles, busheling scrap, sheet bar crop ends and locomotive axles, some of which are up at least $2 per ton. Large consumers are showing more interest in the market and two have been quite liberal buyers for the first time in more than a month. We note sales of 5000 to 6000 tons of selected heavy steel scrap at $14.75 to $15, most of it at the higher price; 1000 tons of low phosphorus melting stock at $19.50; 500 tons of borings at $9.60, and 300 tons of turnings at $8.75, all delivered. Prices on nearly all grades are slightly higher this week. Dealers quote for delivery in the Pittsburgh and nearby districts that take the same rates of freight, as follows, per gross ton:

Heavy steel melting scrap, Steubenville, Follansbee, Brackenridge, Sharon, Monessen, Midland and Pittsburgh delivery	$14.75 to $15.00
Compressed side and end sheet scrap	13.00 to 13.25
No. 1 foundry cast	13.50 to 13.75
Bundled sheet scrap, f.o.b. consumers' mills, Pittsburgh district	12.25 to 12.50
Rerolling rails, Newark and Cambridge, Ohio, Cumberland, Md., and Franklin, Pa.	14.75 to 15.00
No. 1 railroad malleable stock	13.25 to 13.50
Railroad grate bars	9.75 to 10.00
Low phosphorus melting stock	19.50 to 20.00
Iron car axles	20.50 to 21.00
Steel car axles	19.00 to 19.50
Locomotive axles, steel	19.75 to 20.25
No. 1 busheling scrap	12.50 to 12.75
Machine shop turnings	8.25 to 8.50
Old carwheels	13.00
Cast-iron borings	9.50 to 9.75
*Sheet bar crop ends	14.00 to 14.50
Old iron rails	14.00 to 14.50
No. 1 railroad wrought scrap	14.25 to 14.50
Heavy steel axle turnings	10.75 to 11.00
Heavy breakable cast scrap	12.50 to 12.75

*Shipping point.

Chicago

CHICAGO, ILL., Oct. 27, 1915.—(*By Wire.*)

The buying of 18,000 cars in which several railroads participated and for which fully 250,000 tons of steel will be required, orders for 70,000 tons having already been placed, indicates the magnitude of railroad purchasing. Rail requirements also appear far from satisfied, orders since last week totaling 42,000 tons, with an additional 7000 tons about to be closed. Track fastenings have been bought in corresponding volume, one of the large orders being for 9000 tons from the Baltimore & Ohio. The Wabash and Chicago & Eastern Illinois have taken somewhat smaller tonnages, and the Burlington is in the market for abut 6000 tons. The Illinois Central's order for 59 locomotives is also noted. In view of the tremendous tonnages that have been booked by the steel mills and the general knowledge of their sold-up condition, it is interesting to note to what a limited extent the question of delayed deliveries is a matter of concern. It is possible that this may be attributed to the very moderate buying of steel for ordinary projects, and in the case of the railroads to the fact that they are not buying to meet urgent necessities. The attitude of the mills, following the rapid rate at which contracts were being placed, appears to have resulted in a noticeable slackening of activity in this direction. In this market 1.45c., Pittsburgh, can still be done on bars, plates and shapes, but most of the mills are firmly on the 1.50c. basis, even plates having come up to that level. Blue annealed and black sheets have been advanced $2 per ton and bar iron is up a like amount. The selling of pig iron continues

so actively and in such volume that the furnaces have been easily able to maintain their maximum basis of prices and market conditions show little variation, regardless of the tonnage under consideration. Without any marked increase in sales and with an apparent plenty of scrap available, prices for old material hardened perceptibly in the course of the week and the attitude of those who have scrap to sell is decidedly firm.

Pig Iron.—The situation at Chicago is rapidly approaching a condition of maximum production. With the second Federal furnace to be blown in by Dec. 1, and with the last idle Milwaukee stack to be in blast before the first of the year, there will remain inactive only two furnaces of lesser capacity. These latter are not expected to operate before the opening of navigation next spring. Pig-iron sales last week evidenced no diminution in volume or demand. So long a period has elapsed since the foundry melt in this district approached a normal tonnage that the present long period of heavy buying brings with it an awakening to the magnitude of possible capacity. For local iron the market is well defined on the basis of $15.50. Even basic iron was sold last week at that price. In view of the present relative prices of coke and charcoal iron, increased sales of the latter would not be a surprising development in some parts of this territory. Prices for iron from the South range from $12 for northern Alabama prompt shipment iron to $13 for first quarter. At the former price a number of sales have been consummated, Birmingham irons being generally held at $12.50 for the remainder of the year. The following quotations are for iron delivered at consumers' yards, except those for Northern foundry, malleable Bessemer and basic iron, which are f.o.b. furnace, and do not include a switching charge averaging 50c. per ton:

Lake Superior charcoal, Nos. 2 to 5	$15.75 to $16.25
Lake Superior charcoal, No. 1	16.25 to 16.75
Lake Superior charcoal, No. 6 and Scotch	16.75 to 17.25
Northern coke foundry, No. 1	15.50 to 16.00
Northern coke foundry, No. 2	15.25 to 15.50
Northern coke foundry, No. 3	14.75 to 15.25
Southern coke, No. 1 f'dry and 1 soft.	17.00 to 17.50
Southern coke, No. 2 f'dry and 2 soft.	16.50 to 17.00
Malleable Bessemer	15.50
Standard Bessemer	18.50
Basic	15.00 to 15.50
Low phosphorus	26.50 to 27.00
Silvery, 8 per cent	21.00 to 21.50
Silvery, 10 per cent	21.50 to 22.00

(*By Mail*)

Rails and Track Supplies.—In addition to rail purchases mentioned a week ago, there was bought in this market last week about 30,000 tons. Among the purchasers were the Missouri, Kansas & Texas, Wabash, Chesapeake & Ohio and other roads which were adding to earlier buying or were in the market for rails for particular extension work. In the current week 15,000 tons was booked, and 7000 tons is expected to be placed within a few days. The buying of track fastenings has been heavy in proportion to rail purchases. Prominent among the business still to be placed is 6000 tons of tie plates for the Burlington. We quote standard railroad spikes at 1.65c. to 1.70c., base; track bolts with square nuts, 2.05c. to 2.10c., base, all in carload lots, Chicago; tie plates, $30, f.o.b. mill, net ton; standard section Bessemer rails, Chicago, 1.25c., base, open hearth, 1.34c.; light rails, 25 to 45 lb., 1.16c.; 16 to 20 lb., 1.21c.; 12 lb., 1.26c.; 8 lb., 1.31c.; angle bars, 1.50c., Chicago.

Structural Material.—The week was featured by the placing of some 18,000 cars, for which at least 70,000 tons of steel has already been ordered. The total steel requirements will doubtless approximate 250,000 tons. Considering the number of railroads participating, as well as the number of cars purchased, this constitutes as important an activity in cars as this market has ever witnessed. New York Central Lines placed 4000 gondolas with the Standard Steel Car Company, 1000 automobile cars with Haskell & Barker and 1000 with the Pullman Company. The Pullman Company also took 2000 Western Maryland hoppers and 500 Central of Georgia fruit cars. The Illinois Central bought 1000 refrigerator and 500 automobile cars from Haskell & Barker. The American Car & Foundry Company took 2000 New York Central, all-steel box cars, 500 Missouri Pacific box cars and 1000 underframes for the Gadsden Car Company. The Louisville & Nashville bought 1000 steel underframe box cars from the Mount Vernon Car Company. In addition the Illinois Central is understood to have placed fifty-nine locomotives with the Lima Locomotive Company. For architectural work structural steel is in little more than moderate demand, and contracts for fabricated material placed last week, though rather numerous, were, with the exception of railroad bridge tonnage, small in size. The American Bridge Company will furnish 3000 tons of bridge steel for the Great Northern Railway and 2500 tons for the Northern Pacific. It will also fabricate 110 tons for the Milwaukee Railroad and 1500 tons for the extension to the Cuyahoga Works of the American Steel & Wire Company. Alterations to the Fair Store, Chicago, will require 512 tons to be furnished by the South Halsted Street Iron Works. The new Times Building, Seattle, Wash., involving 1300 tons, was taken by the Vulcan Mfg. Company. About 1150 tons additional, distributed among six contracts, was also placed. The new tinplate mill to be built at Gary is the only project in sight for which any considerable tonnage of building steel will be required. Contracting appears to have fallen off very markedly, largely due to the fact that the mills find themselves sold up as far, or even farther than they care to be. Thus far mill deliveries have not been so much delayed as the situation might suggest, in fact the purchases of regular customers have been moderate and the larger mills have been at particular pains to serve them well. We quote for Chicago delivery 1.639c. to 1.689c.

We quote for Chicago delivery of structural steel out of store 2c.

Plates.—Apparently the plate market has at last stiffened up to a basis of equality with bars and shapes. There is no likelihood of a better price than 1.45c., Pittsburgh, while one of the smaller mills which last week opened its books for next year's business at 1.50c., Pittsburgh, took in enough business in two days to occasion its withdrawal from the market. We quote for Chicago delivery of plates from mill 1.639c. to 1.689c.

We quote for Chicago delivery of plates out of stock 2c.

Sheets.—The price of black sheets has been advanced by the mills $2 per ton, to the basis of 2.289c., Chicago. For blue annealed sheets the market is rather difficult to determine, but the local independent interest is quoting 1.70c., Pittsburgh. The various gages of galvanized sheets are being quoted at unrelated prices, depending upon circumstances, with the heaviest gages relatively cheapest. For No. 28, 3.789c., Chicago, is being asked. We quote for Chicago delivery from mill, No. 10 blue annealed, 1.789c. to 1.889c.; No. 28 black, 2.289c.; No. 28 galvanized, 3.789c.; heavy gages, 3.439c.

We quote for Chicago delivery from jobbers' stock as follows, minimum prices applying on bundles of 25 or more: No. 10 blue annealed, 2.20c.; No. 28 black, 2.55c.; No. 28 galvanized, 4.35c.

Bars.—Sales of standard forging billets totaling about 5000 tons were made last week on the basis of $32. Bar-iron prices were advanced $2 per ton, and, on the strength of this advance, specifications and orders taken at the 1.35c. price ran the bookings of the week up to a considerable tonnage. The iron mills are, however, scarcely more than comfortably supplied with busines. Hard steel bars are being held at 1.40c. We quote mill shipments, Chicago, as follows: Bar iron, 1.45c.; soft steel bars, 1.689c.; hard steel bars, 1.40c.; shafting, in carloads, 63 per cent off; less than carloads 58 per cent off.

We quote store prices for Chicago delivery: Soft steel bars, 1.90c.; bar iron, 1.90c.; reinforcing bars, 1.85c. base, with 5c. extra for twisting in sizes ½ in. and over and usual card extras for smaller sizes; shafting 52 per cent off.

Rivets and Bolts.—A sharp advance in the price of rivets in the principal markets puts the current quotation at 2.30c., Chicago. The advance in the price of bars and wire rods has been followed by an increase in bolt prices, discounts having been reduced by 5 per cent. We quote as follows: Carriage bolts up to ⅝ x 6 in., rolled thread, 80-5; cut thread, 80; larger sizes, 75-5; machine bolts up to ⅝ x 4 in., rolled thread, with hot pressed

square nuts, 80-10; cut thread, 80-5; larger sizes, 75-10; gimlet point coach screws, 80-10; hot pressed nuts, square, $6 off per cwt.; hexagon, $7 off per cwt. Structural rivets, ¾ to 1¼ in., 1.95c. to 2c., base, Chicago, in carload lots; boiler rivets, 10c. additional.

We quote out of store: Structural rivets, 2.10c.; boiler rivets, 2.20c.; machine bolts up to ¾ x 4 in., 75-15; larger sizes, 70-10-10; carriage bolts up to ¾ x 6 in., 75-10; larger sizes 70-15 off; hot pressed nuts, square, $6, and hexagon, $6.70 off per cwt.

Wire Products.—In accordance with the advance of $2 per ton in the price of all of the common forms of wire announced last week, we have revised our quotations as follows: Quotations to jobbers, per 100 lb. are as follows: Plain wire, No. 9 and coarser, base, $1.889; wire nails, $2.039; painted barb wire, $2.189; galvanized barb wire, $2.889; polished staples, $2.189; galvanized staples, $2.889, all Chicago.

Cast-Iron Pipe.—With the exception of a few small municipal tonnages, the demand for water pipe is seasonably limited. The advancing market has brought out inquiry for gas pipe, and there is prospect of a substantial tonnage being placed in the near future. We quote as follows, per net ton, Chicago: Water pipe, 4 in., $28; 6 in. and larger, $26, with $1 extra for class A water pipe and gas pipe.

Old Material.—With conditions such as they are with respect to finished products in iron and steel lines, weakness in sentiment in the scrap market would not long exist even though buying were light and the supply of old material in excess of demand. This seems to be the explanation of the present market strength. Consumers of scrap are buying only moderately, particularly the rolling mills which have good stocks of scrap and none too good orders for finished products. Railroad offerings are again liberal, the Burlington having 2000 tons and the Northern Pacific 9000 tons in addition to lists closed Monday by the Rock Island and St. Paul. We quote for delivery at buyers' works, Chicago and vicinity, all freight and transfer charges paid, as follows:

Per Gross Ton

Old iron rails	$13.50 to $14.00
Relaying rails	19.50 to 20.50
Old carwheels	12.00 to 12.25
Old steel rails, rerolling	13.50 to 14.00
Old steel rails, less than 3 ft	13.25 to 13.75
Heavy melting steel scrap	11.75 to 12.00
Frogs, switches and guards, cut apart	11.75 to 12.00
Shoveling steel	11.50 to 11.75
Steel axle turnings	9.25 to 9.75

Per Net Ton

Iron angles and splice bars	$14.00 to $14.25
Iron arch bars and transoms	14.75 to 15.25
Steel angle bars	10.75 to 11.25
Iron car axles	15.50 to 16.00
Steel car axles	16.50 to 17.00
No. 1 railroad wrought	11.75 to 12.25
No. 2 railroad wrought	11.00 to 11.50
Cut forge	11.00 to 11.50
No. 1 busheling	9.50 to 10.00
No. 2 busheling	7.25 to 7.50
Pipes and flues	8.50 to 9.00
Steel knuckles and couplers	11.25 to 11.75
Steel springs	12.50 to 13.00
No. 1 boilers, cut to sheets and rings	8.50 to 8.75
Boiler punchings	10.75 to 11.00
Locomotive tires, smooth	11.25 to 11.75
Machine shop turnings	7.00 to 7.25
Cast borings	6.50 to 7.00
No. 1 cast scrap	10.50 to 11.00
Stove plate and light cast scrap	8.75 to 9.00
Grate bars	8.50 to 8.75
Railroad malleable	10.25 to 10.75
Agricultural malleable	9.25 to 9.75

In response to inquiries, the officers of the Driggs-Seabury Ordnance Company state that it has no interest in, nor any connection whatever with, an organization known as the Driggs Ordnance Company, which is said to have filed recently incorporation papers at Albany, N. Y. The Driggs-Seabury Ordnance Company has its works at Sharon, Pa., and is not a New York corporation. None of its officers has any knowledge as to the objects or activities of the Driggs Ordnance Company, nor as to its composition or location. It is hoped that the similarity of names may not lead to confusion of the two companies in the public mind.

The Mahoning & Shenango Valley Light Company, Youngstown, Ohio, will double the capacity of its power plant at Lowellville. It plans to spend fully $750,000 on modern electrical equipment and extensions.

Philadelphia

PHILADELPHIA, PA., Oct. 26, 1915.

Inquiry from abroad continues to be heavy, and the trade notes with considerable satisfaction that specifications now arriving conform more closely to American standards. Another development is a swing in demand toward blooms and forgings, such as are required in the manufacture of the larger sizes of shells. At the same time the aggregate of inquiry for 3-in. rounds is large. Quotations for plates, shapes and bars show considerable variance, depending on the conditions prevailing at individual mills. Although the minimum price is asserted to be 1.609c., Philadelphia, it is intimated that a few of the larger producers are contracting at 1.559c., Philadelphia. Eastern Pennsylvania mills are quoting up to 1.759c., Philadelphia, on plates, while the minimum on shapes is given as 1.659c. In many cases contracts which should be filled by Jan. 1 will run into 1916 because of the present crowded state of the mills. The aggregate of basic pig iron taken last week by an eastern Pennsylvania plate mill was 58,000 tons. Low phosphorus pig iron continues active. Virginia iron is stronger. The movement in foundry iron has been only fair at best, and the trade is wondering why it does not move more in conjunction with steel-making pig iron and steel products.

Pig Iron.—The total amount of second quarter basic which was taken last week by an eastern Pennsylvania plate mill was 58,000 tons. It was divided among six producers and the price, as already stated, was $17.50, delivered. No other basic transactions are reported. There is a feeling on the part of some of the pig-iron trade that the plate mill got its iron cheap. Buying of foundry iron is almost entirely confined to small lots and is disappointing in regard to both volume of sales and prices. One of the better transactions of the week involved 1700 tons of charcoal iron, the price of which was $16.25, Buffalo, taken by a carwheel maker. Pipe makers have been quietly inquiring and it would not be surprising if they were to take a good tonnage. For eastern Pennsylvania No. 2X, shipment this year, $16.29, delivered, can be done, $1 more being asked for first quarter. Other interests continue to ask $16.89, delivered, on shipments this quarter, and on contracts extending into the first quarter. Shipments of Virginia iron continue on an excellent scale. One Virginia producer announced in the week that it was out of the market on No. 2X. Another, who has been low seller, advanced its price 25c. last week, making its quotation for No. 2X $16.50, delivered. Both standard and Lebanon low phosphorus continue active. Sales of the former have been made at $26.50 to $27.50, delivered, and of the latter at $24, furnace. Quotations for standard brands, delivered in buyers' yards, shipment this year, range about as follows:

Eastern Penna., No. 2X foundry	$16.25 to $16.75
Eastern Penna., No. 2 plain	16.00 to 16.50
Virginia, No. 2X foundry	16.50
Virginia, No. 2 plain	16.25
Gray forge	15.25 to 15.50
Basic	17.00 to 17.50
Standard low phosphorus	26.50 to 27.50

Iron Ore.—Arrivals of foreign ore at this port in the week ended Oct. 23 comprised 16,334 tons from Sweden, 5100 tons from French Africa and 5000 tons from Cuba. With ocean vessels at a premium, only occasional shipments can be expected, except where contracts must be fulfilled. Meanwhile eastern Pennsylvania furnaces are well supplied with Eastern and Lake Superior ores.

Ferroalloys.—In view of the pace at which the steel mills are operating, it is generally asserted that there is no justification for any weakness in the price of 80 per cent ferromanganese. It is admitted that recent arrivals may have made spot a trifle easier but the general situation is stronger than ever and the quotation on future shipments is unchanged at $100, seaboard. At this port 214 tons arrived from England last week. Spiegeleisen is very strong. It is reported that the New Jersey Zinc Company is negotiating for a furnace at Parryville, Pa., with which to increase its output of spiegeleisen. For 50 per cent ferrosilicon the

quotations range from $85 to $87, Pittsburgh, according to quantity.

Bars.—Ordinary steel bars are quotable at 1.609c. to 1.659c., Philadelphia, but orders are taken subject to confirmation and some have been declined. Several last quarter contracts will run into 1916 because of the inability of the mills to get them completed by Jan. 1. The inquiry for steel rounds continues to be heavy. Makers quote 3c. Common iron bars are strong at 1.559c., Philadelphia.

Plates.—Quotations range all the way from 1.45c., Pittsburgh, or 1.609c., Philadelphia, to 1.60c., Pittsburgh, or 1.759c., Philadelphia. A leading mill which specializes in boiler materials, and has a well equipped plant for bending and forming, quotes at the highest level for shipments inside of 10 weeks and is filled with work for the remainder of the year. It has taken a few contracts for next year, but is seeking to avoid them. Other mills are not hard pressed with orders and would gladly take on business at about 1.609c., Philadelphia. The Bull Steamship Company has placed two boats with the Maryland Steel Company, the Standard Oil Company two with the Harlan & Hollingsworth Corporation, and the Munsen Steamship Company one with the Newport News Shipbuilding Company. The Norfolk & Western Railroad has ordered 20,000 tons of miscellaneous steel products it requires for the construction of 1000 freight cars. Most of the material will be supplied by Pittsburgh mills. The Pennsylvania Railroad will buy steel products for 100 freight cars, and the Southern and other lines are expected to buy similar material.

Structural Material.—The minimum quotation for shapes by Eastern mills is 1.659c., Philadelphia, and from this level quotations range up to 1.759c., Philadelphia. Small mill sizes are scarce and command premiums. Bids are to be submitted by Nov. 15 on 3000 tons for a central heating and lighting plant for the Treasury Department, Washington, D. C. Bids are in on a terminal structure for the Southern Railroad at Macon, Ga. Pier sheds, which the Norfolk & Western will build at Norfolk, Va., will require 2000 tons. The Southern Virginia has placed with the Virginia Bridge & Iron Company about 2500 tons of bridge material.

Sheets.—Automobile makers are the chief buyers of sheets, and some of them are beginning to complain of the higher prices now asked. For No. 10 blue annealed quotations range from 1.759c. to 1.859c., Philadelphia.

Billets.—Quotations continue extremely irregular, largely depending on conditions at various mills. Ordinary rerolling billets are quoted at $30 to $32, Philadelphia, and forging billets at $36 to $40. Sales of the latter have been made as high as $48 and $50. There is a large amount of inquiry from both domestic and foreign sources, with the latter predominating. Considerable business has been turned away by at least one mill, which is satisfied if it can take care of its regular customers. The growing demand for the larger sizes of shells is expressing itself in a greater call for blooms and forgings.

Old Material.—The market has been somewhat spasmodic in the last week, but on the whole quiet. The mills are consuming what they are receiving under contract and their interest is confined to bargains. Heavy shipments of recent weeks have operated to deplete the stocks in dealers hands. Quotations for delivery in buyers' yards in this district, covering eastern Pennsylvania and taking in freight rates from 35c. to $1.35 per gross ton, are as follows:

No. 1 heavy melting steel	$14.50 to $15.00
Old steel rails, rerolling	15.50 to 16.00
Low phosp. heavy melting steel scrap	20.00 to 20.50
Old steel axles	19.50 to 20.50
Old iron axles	22.00 to 23.00
Old iron rails	17.50 to 18.00
Old carwheels	13.50 to 14.00
No. 1 railroad wrought	16.00 to 16.50
Wrought-iron pipe	13.00 to 13.50
No. 1 forge fire	11.00 to 11.50
Bundled sheets	11.00 to 11.50
No. 2 busheling	9.50 to 10.00
Machine shop turnings	10.00 to 10.25
Cast borings	10.00 to 10.50
No. 1 cast	14.00 to 14.50
Grate bars, railroad	10.50 to 11.00
Stove plate	10.50 to 11.00
Railroad malleable	10.50 to 11.00

Coke.—The market is active and prices are considerably higher. Prompt furnace coke has jumped to $2.50 to $2.65 per net ton at oven, and up to $3 is asked. On first half contract furnace coke is quoted at $2.50 to $3 per ton, and $2.50 is said to have been refused. Foundry coke has stiffened also and sales have been made at $2.75 for prompt delivery. Contract foundry is quoted at $2.60 to $2.85. Freight rates from the principal producing districts are as follows: Connellsville, $2.05; Latrobe, $1.85 and Mountain, $1.65.

Buffalo

BUFFALO, N. Y., Oct. 26, 1915.

Pig Iron.—Sales in this district for the past two weeks have aggregated 60,000 tons of the various grades of foundry iron. Developments subsequent to the forwarding of last week's report brought the total for that week up to 30,000 tons, and the tonnage placed in the current week is of equal amount. The delivery specified is largely for this year; some being for first quarter and a small amount for second quarter of 1916. In addition to the foundry grades sold there have been quite heavy sales of charcoal irons the past week or two. All of the furnaces of the district are shipping very heavily on contracts and in excess of their current production. There is a pronounced shortage of high-silicon iron, amounting to almost a famine, with a consequent appreciation in price. Prices for all grades are very firm, with indications of early further advances. We quote for current and first quarter delivery, f.o.b. furnace, Buffalo, as follows:

Foundry of 4 to 5 per cent silicon	$17.00
No. 1 foundry	$16.25 to 16.50
No. 2 X foundry	15.50 to 16.00
No. 2 plain	15.50 to 15.75
No. 3 foundry	15.50
Gray forge	15.50
Malleable	15.50 to 16.00
Bessemer	16.00 to 16.50
Basic	16.50
Charcoal—regular brands and analysis	16.75 to 17.75
Charcoal—special brands and analysis	20.00 to 21.00

Finished Iron and Steel.—The heavy demand for steel products continues, with a growing shortage, and deliveries becoming more extended every day. A number of buyers, finding it impossible to obtain all the material wanted from their regular sources of supply, are endeavoring to place orders with other mills or agencies to insure required deliveries; but mills, as a rule, decline to quote on this type of business, taking the position that they must care for their established trade in preference to accepting such new business. Buyers have begun to bid for material, and in some instances have offered premiums of several dollars per ton to induce mills to accept the business for delivery at their convenience. While it has been customary, in this market, for jobbers to place contracts about this time of the year to take care of early spring shipments, it is understood mills are declining to entertain such contracts at the present time, restricting their sales to strictly 60-day contract business. Additional inquiries for wire rods have appeared in the Canadian market without finding sellers, although it is understood that $33 per gross ton had been offered. It is reported that the Imperial Steel Wire Company, Collingwood, Ontario, is installing machinery for the manufacture of barb wire, and will have available for sale 1000 tons a month before the close of the year. The Onondaga Building & Construction Company, Syracuse, has received general contract for the local Delaware Avenue school, requiring 600 tons of steel. The Levering & Garrigues Company has contract for 900 tons for the Kinney & Woodward commercial building in that city. W. S. Rae, Pittsburgh, has general contract for the State highway bridge at Lyons Falls, N. Y., taking 200 tons. The Lackawanna Bridge Company has taken contract for fabricated steel for blast-furnace extension to the plant of the Brier Hill Steel Company, Youngstown, Ohio, involving 2000 to 2500 tons. The John W. Cowper Company, Buffalo, has general contract for addition to the shops of the Contractors' Plant Mfg. Company, Buffalo, requiring 100 tons, for which the Ferguson Steel & Iron Company, Buffalo, has the subcontract.

Old Material.—The week has been an active one and some heavy sales have been made, heavy melting steel leading in the tonnage sold. Orders are pending for several large quantities. The price for this commodity advanced 25c. per ton. The demand for low phosphorus steel is also large, and this scrap is being picked up rapidly by consumers. Machinery cast scrap and No. 1 busheling scrap have advanced 50c. Machine shop turnings still remain the weak item on the list, as there is an immense amount of this scrap being made, running above the consumption demand. Borings are in fair demand. We quote dealers' asking prices, per gross ton, f.o.b. Buffalo, as follows:

Heavy melting steel	$13.25 to $13.75
Low phosphorus steel	17.50 to 18.00
No. 1 railroad wrought scrap	12.50 to 13.00
No. 1 railroad and machinery cast	13.00 to 13.50
Old steel axles	19.00 to 19.50
Old iron axles	19.50 to 20.00
Old carwheels	12.75 to 13.25
Railroad malleable	12.50 to 13.00
Machine shop turnings	6.50 to 7.00
Heavy axle turnings	10.00 to 10.50
Clean cast borings	7.50 to 7.75
Old iron rails	15.50 to 16.00
Locomotive grate bars	9.50 to 10.00
Stove plate (net ton)	8.50 to 9.00
Wrought pipe	10.50 to 11.00
Bundled sheet scrap	9.50 to 10.00
No. 1 busheling scrap	10.50 to 11.00
No. 2 busheling scrap	9.00 to 9.50
Bundled tin scrap	10.00

Cleveland

CLEVELAND, OHIO, Oct. 26, 1915.

Iron Ore.—The Bethlehem Steel Company came into the market last week for 50,000 tons of iron ore for this season's delivery, but its efforts to obtain this ore were apparently unsuccessful. While shippers could furnish the kind of ore wanted, boats could not be had to bring down the ore. Two or three inquiries for smaller lots have had similar outcome. Some inquiries have come out for vessel tonnage for ore for next season's delivery and one shipper is reported to have offered to place a three-year contract for boats at the present rate. As an advance of 50c. is expected in the price of ore for next season, vessel men hope to get some benefit from this by an advance in carrying charges. We quote prices as follows delivered the lower lake ports: Old Range Bessemer, $3.85; Mesaba Bessemer, $3.45; Old Range non-Bessemer, $3; Mesaba non-Bessemer, $2.85.

Pig Iron.—A further advance in prices on foundry iron has been made by Cleveland and some other Lake furnaces. The recent ruling price of $15 for No. 2 foundry has been advanced to $15.50 by one local furnace interest and to $16 by another. Some business has been taken at $15.50. In Toledo the price has been put up to $16. In the Valley, which has been the weak spot, price advances have not been made but $15 is being maintained. There is considerable activity in foundry and malleable iron in the Central West, but the northern Ohio market is rather dull, although it shows some improvement in the volume of orders in lots of 500 tons and under. Spot Bessemer iron has sold at $16.50, but not in a lot large enough to establish a market price. Considerable inquiry is pending for basic iron for the first quarter; Southern iron is very firm and $12.50, Birmingham, now appears to be the minimum price for this year. For the first quarter and half $13 to $13.50 are the ruling quotations. Some small lot sales are reported for the first quarter. Low phosphorus iron has advanced to $26. The price on Ohio silvery iron is unchanged, but a further advance of 50c. per ton is looked for. We quote, delivered Cleveland, as follows:

Bessemer	$16.95
Basic	15.80
Northern No. 2 foundry	15.80
Southern No. 2 foundry	16.50 to 17.00
Gray forge	15.30
Jackson Co. silvery, 8 per cent silicon	20.12 to 20.62
Standard low phos., Valley furnace	26.00

Coke.—Labor shortage and increased demand have caused a sharp advance in prices on furnace coke for prompt shipment, and it is now quoted at $2.50 to $2.65 per net ton at oven. This strength has affected foundry coke, which is quoted at $2.50 to $2.75 for prompt shipment and $2.75 to $3 for contracts.

Finished Iron and Steel.—The delivery situation is daily becoming a more serious one with the mills. Consumers are pressing mills for shipments, and are crowding them with specifications far ahead of the regular monthly allotments on contracts and many are endeavoring to secure contracts for additional steel. Some contracts are being taken, but most of the mills are refusing to take additional orders for first quarter delivery. The market is very firm at 1.40c. and 1.45c., Pittsburgh, for steel bars, plates and structural material. Plate mills are now well filled and quotations up to 1.65c., Pittsburgh, are being made by Eastern mills for early delivery. The problem of securing forging billets is daily becoming more serious, and $40, Pittsburgh, now appears to be the minimum price, but higher prices are being paid. Among the new inquiries is one from a Youngstown manufacturer for 4000 tons of 6¼-in. rounds for high explosive shells. Recent locomotive orders taken by the Lima Locomotive Corporation will require 2000 tons of bars, plates and structural material. The demand for sheets is active and some first-quarter contracts for black sheets are being taken at 2.25c., at mill, for No. 28. For early delivery we quote black sheets at 2.10c. to 2.20c. for No. 28, blue annealed sheets at 1.60c. to 1.70c. for No. 10 and galvanized at 3.50c. to 3.60c. for No. 28. Shafting has advanced to 58 per cent off for carloads and 55 per cent off for less than carloads. Warehouse business is heavy and jobbers have again advanced prices. For stock orders we quote steel bars at 2.10c. and plates and structural material at 2.20c. The warehouse price on blue annealed sheets has been advanced to 2.25c.

Bolts, Nuts and Rivets.—The new demand for bolts and nuts is active, but so far there has not been a great deal of contracting for next year. Prices are very firm. The demand for rivets is heavy and the prices are firm. Bolt and nut discounts are as follows: Common carriage bolts, ⅜ x 6 in., smaller or shorter, rolled thread, 75, 10 and 10 per cent; cut thread, 75, 10 and 5; larger or longer, 70, 10 and 10; machine bolts with h.p. nuts, ⅜ x 4 in., smaller or shorter, rolled thread, 75, 10, 10 and 5; cut thread, 75, 10 and 10 per cent; larger and longer, 75 and 5; coach and lag screws, 80 and 15; square h.p. nuts, blank or tapped, $5.80 off the list; hexagon, h.p. blank or tapped, $6.30 off; c.p.c. and t. square nuts, blank or tapped, $5.30 off; hexagon, ⅝ in. and larger, $6.75 off; 9/16 in. and smaller, $7.25 off; cold pressed semi-finished hexagon nuts, ⅝ in. and larger, 85 off; smaller, 85 and 10.

Old Material.—While the market is not very active, prices are firm and several grades of steel-making scrap are higher. The only active grade that shows any weakness is borings, sales on which are reported at $6.75, or 25c. lower than recent prices. Heavy melting steel, which has been held recently at $13 for Cleveland delivery, is somewhat firmer and one local mill has purchased 1500 tons at $13.25. Most consumers have bought scrap in excess of their requirements and are still willing to take on additional tonnage for future delivery. We quote, f.o.b., Cleveland, as follows:

Per Gross Ton

Old steel rails	$13.00 to $13.50
Old iron rails	14.00 to 14.50
Steel car axles	19.00 to 20.00
Heavy melting steel	13.00 to 13.25
Old carwheels	11.75 to 12.00
Relaying rails, 50 lb. and over	22.50
Agricultural malleable	11.50 to 12.00
Railroad malleable	13.25 to 13.50
Steel axle turnings	11.50 to 12.00
Light bundled sheet scrap	11.50 to 11.75

Per Net Ton

Iron car axles	$17.25 to $17.75
Cast borings	6.75 to 7.00
Iron and steel turnings and drillings	6.00 to 6.25
No. 1 busheling	10.75 to 11.00
No. 1 railroad wrought	12.25 to 12.50
No. 1 cast	11.00 to 11.25
Railroad grate bars	9.50
Stove plate	9.25 to 9.50

The Jones & Laughlin Steel Company, Pittsburgh, has placed contracts with the Cleveland Crane & Engineering Company, Cleveland, Ohio, for one 40, one 30, two 15, one 10 and one 5 ton cranes to be installed in its Aliquippa works. All will have large spans, ranging from 60 to 120 ft.

Cincinnati

CINCINNATI, OHIO, Oct. 27, 1915.—(*By Wire.*)

Pig Iron.—The general marking up of quotations appears to have somewhat cut off inquiries. Southern No. 2 foundry is now being held at $12.50 to $13 for this year's shipment although a small quantity of furnace iron is available to-day at $12 Birmingham basis for immediate shipment. Northern foundry has also been advanced to $15.25 for this year and from $15.50 to $16 for first and second quarters. There is a growing scarcity of basic, and it is difficult to name any prompt prices in the Hanging Rock district as there is very little basic for sale in that territory and one interest is asking $17 at furnace for either prompt or future shipment. One consumer of basic in this territory has provided for future requirements through the first half and another melter is now endeavoring to purchase a supply for the third and fourth quarters of next year. Quite a lot of Lake Superior charcoal was sold last week for first half shipment, among sales reported being 2500 tons and 500 tons in Michigan and 1000 tons, 800 tons and 500 tons to Indiana melters. Malleable sales include 1000 tons to a Central Western melter, 600 tons to a Southern consumer and other smaller sales in Indiana and Michigan. A local melter bought approximately 2000 tons of mixed Northern and Southern foundry iron. Among foundry iron sales to Indiana consumers are several averaging about 500 tons each. It is generally understood that practically all of the speculative Southern iron bought in this territory for last quarter shipment has changed hands and that it will not now reckon as a factor in disturbing market prices. The high silicon irons are very firm, with prices advancing. Approximately 300 tons of 12 per cent Bessemer ferrosilicon was sold for shipment in the next four months at $24.50 at furnace. Based on freight rates of $2.90 from Birmingham and $1.26 from Ironton, we quote, f.o.b. Cincinnati, as follows:

Southern coke, No. 1 f'dry and 1 soft	$15.90 to $16.40
Southern coke, No. 2 f'dry and 2 soft	15.40 to 15.90
Southern coke, No. 3 foundry	14.90 to 15.40
Southern No. 4 foundry	14.40 to 14.90
Southern gray forge	13.90 to 14.40
Ohio silvery, 8 per cent silicon	19.76
Southern Ohio coke, No. 1	17.51 to 17.76
Southern Ohio coke, No. 2	16.51 to 16.76
Southern Ohio coke, No. 3	16.26 to 16.51
Southern Ohio malleable Bessemer	17.01 to 17.26
Basic, Northern	17.01 to 17.26
Lake Superior charcoal	16.70 to 17.70
Standard Southern carwheel	24.40 to 24.90

(*By Mail*)

Coke.—Coke is much stronger in all districts and there is some contracting for foundry coke, mostly for nearby shipment. Considerable business is in sight, as many foundry consumers will have to purchase more than their contracts call for. The stove foundries are consuming considerably more than they have in the past six months. As far as is known no nearby furnace coke contracts have been made here lately. We quote Connellsville 48-hr. brands at $2.35 to $2.50 per net ton at oven and 72-hr. at $2.65 to $3. Wise County and Pocahontas furnace grades range from $2.50 to $2.75 and foundry coke at $2.75 to $3. New River grades are about on the same level as Wise County and Pocahontas quotations.

Finished Material.—Business in reinforcing concrete bars has fallen off somewhat, but as cold weather is at hand this was naturally to be expected. It is somewhat surprising that local warehouses report a fairly good sale for small structural shapes, which are quoted at 2.10c. from stock. The price on plain steel bars is 2c. The local store price on No. 10 blue annealed sheets is 2.20c. and on No. 28 galvanized 4.25c. to 4.35c. Some cold-rolled rounds can be obtained from warehouse stocks at 52 per cent off list and at 50 per cent off for squares, flats and hexagons. Mill deliveries are slow on many kinds of finished material, and April 1 is named as the best that several manufacturers can do on hoops, bands and iron and steel bars.

Old Material.—The market is somewhat excited and prices have been advanced on practically all grades. There is an increasing demand from rolling mills, and stove foundries are also using a larger amount than for some time past. The strong position of the pig-iron market has had considerable effect on scrap quotations. The minimum figures given below represent what buyers are willing to pay for delivery in their yards, southern Ohio and Cincinnati, and the maximum quotations are dealers' prices, f.o.b., at yards:

Per Gross Ton	
Bundled sheet scrap	$9.25 to $9.75
Old iron rails	13.00 to 13.50
Relaying rails, 50 lb. and up	20.75 to 21.25
Rerolling steel rails	12.00 to 12.50
Heavy melting steel scrap	11.00 to 11.50
Steel rails for melting	11.00 to 11.50

Per Net Ton	
No. 1 railroad wrought	$10.00 to $10.50
Cast borings	6.50 to 7.00
Steel turnings	6.00 to 6.50
Railroad cast scrap	10.50 to 11.00
No. 1 machinery cast scrap	12.00 to 12.50
Burnt scrap	7.50 to 8.00
Old iron axles	16.25 to 16.75
Locomotive tires (smooth inside)	10.25 to 10.75
Pipes and flues	7.75 to 8.25
Malleable and steel scrap	9.00 to 9.50
Railroad tank and sheet scrap	7.00 to 8.25

Birmingham

BIRMINGHAM, ALA., Oct. 25, 1915.

Pig Iron.—The market continues to display an advancing tendency, with regular foundry grades for spot delivery becoming more and more scarce. The producer with the largest available tonnage was forced to turn down an offer of 10,000 tons the past week because of inability to supply Nos. 1 and 2 soft. No producer reports any difficulty in securing $13 for the first quarter of 1916. That appears to be the minimum for that delivery. There are only three large producers in the market. The leading company, which a week ago sold a small lot of No. 1 foundry at $14, has booked a very respectable tonnage for a varied territory the past week at a uniform basis of $13.50 for No. 2 for the first half, making no distinction in quarters. That is the only price which this company quotes. The recent business at that figure was from 4000 to 5000 tons. The largest foundry producer has more than sold its make at $13 for the first half (making no distinction between first and second quarters), and $12.50 spot. A third has sold 10,000 tons at $13 for first quarter and $13.50 for second quarter, and holds for $13 for spot and $13.50 for first half. The fourth large foundry maker continues out of the market, being busy on delivery of iron ordered a long time ago and, it is understood, confident of an advancing market, hence in no hurry to re-enter. The schedule of resuming stacks now includes one of the Republic to blow in Nov. 1, a Sloss-Sheffield which may not be ready before Nov. 15, and one of the Tennessee Company at Bessemer to blow in some time in the month. Shipments are heavy and the Southern demand is bettering with each week. Pipe interests have bought liberally. A firm offer of $13 for first half iron has been made. The week's sales covered Middle Western, Eastern and Southern territory. We quote, per gross ton, f.o.b. Birmingham district furnaces, as follows:

No. 1 foundry and soft	$13.00 to $13.50
No. 2 foundry and soft	12.50 to 13.00
No. 3 foundry	12.00 to 12.50
No. 4 foundry	11.75 to 12.25
Gray forge	11.50 to 12.00
Basic	12.50 to 13.00
Charcoal	21.50 to 22.00

Cast-Iron Pipe.—There has been no change in the lull characterizing the water and gas pipe market beyond the reception of one or two sizeable orders on the part of the leading interest. Manufacture continues on the same scale. There is no improvement in the sanitary pipe trade. We quote, per net ton, f.o.b. pipe shop yards, as follows: 4-in., $22; 6-in. and upward, $20, with $1 added for gas pipe. Prices tend to rise.

Coal and Coke.—Coke is scarcer and an advance is imminent; in fact, some grades have sold above quotations. Texas and Pacific coast points are entering the market liberally. The entire output is easily disposed of. We quote, per net ton, f.o.b. oven, as follows: By-product furnace, $2.50 to $2.75; by-product foundry,

$2.75 to $3; beehive furnace, $2.75 to $3; beehive foundry, $3.10 to $3.30, with some grades still higher.

Old Material.—Dealers are enjoying a good business in almost all lines on account of steel mill and foundry activity. Quotations are strongly maintained. We quote, per gross ton, f.o.b. dealers' yards, as follows:

Old iron axles	$13.50 to $14.00
Old steel axles	13.00 to 13.50
Old iron rails	12.50 to 13.00
No. 1 railroad wrought	9.50 to 10.00
No. 2 railroad wrought	8.50 to 9.00
No. 1 country wrought	8.50 to 9.00
No. 1 machinery cast	9.50 to 10.00
No. 1 steel scrap	9.50 to 10.00
Tram carwheels	9.50 to 10.00
Stove plate	8.00 to 8.50

St. Louis

ST. LOUIS, MO., Oct. 25, 1915.

Pig Iron.—The aggregate pig-iron sales for the week ran to satisfactory figures. The largest sales were 3000 tons of malleable for first half delivery and 350 tons of Lake Superior charcoal. Prices were advanced to $12.50 for No. 2 Southern foundry, Birmingham basis, and to $15.50 for No. 2 Northern, Ironton basis. Ohio silicons have been withdrawn from the market.

Coke.—Insistence on prompt shipment is the feature in coke. Prices are firmer but local by-product coke controls the market.

Old Material.—The demand is strong with indications of an early increase. The Colorado Fuel & Iron Company, it is reported, bought about 10,000 tons of all classes from the railroads. While this was in competition with the dealers, it removed considerable material from the market with attendant strengthening of prices. The local mills are beginning to take a little scrap, largely special lots, though old contract material still largely fills the yards. The movement north and east is active at profitable prices, particularly steel axles, shoveling steel and wrought scrap. Dealers, short of yard space, are buying only especially attractive lots. Relaying rails are strong and hard to get. Lists out during the week include 2200 tons from the Missouri Pacific and 9000 tons from the Northern Pacific. The removal of embargos at most of the local industries would have a markedly buoyant effect on conditions and prices. We quote dealers' prices, f.o.b. customers' works, St. Louis industrial district, as follows:

Per Gross Ton	
Old iron rails	$11.75 to $12.25
Old steel rails, rerolling	12.50 to 13.00
Old steel rails, less than 3 ft	12.50 to 13.00
Relaying rails, standard section, subject to inspection	21.00 to 23.00
Old carwheels	10.50 to 11.00
No. 1 railroad heavy melting steel scrap	11.50 to 12.00
Heavy shoveling steel	10.50 to 10.75
Frogs, switches and guards cut apart	11.50 to 12.00
Bundled sheet scrap	7.50 to 8.00
Per Net Ton	
Iron angle bars	$11.75 to $12.00
Steel angle bars	10.00 to 10.50
Iron car axles	16.25 to 16.50
Steel car axles	16.50 to 17.00
Wrought arch bars and transoms	14.75 to 15.00
No. 1 railroad wrought	10.25 to 10.50
No. 2 railroad wrought	9.75 to 10.25
Railroad springs	11.25 to 11.75
Steel couplers and knuckles	11.00 to 11.50
Locomotive tires, 42 in. and over, smooth inside	12.00 to 12.25
No. 1 dealers' forge	9.25 to 9.50
Mixed borings	6.00 to 6.50
No. 1 busheling	9.00 to 9.50
No. 1 boilers, cut to sheets and rings	7.50 to 8.00
No. 1 railroad cast scrap	10.50 to 10.75
Stove plate and light cast scrap	8.50 to 8.75
Railroad malleable	8.75 to 9.00
Agricultural malleable	7.75 to 8.00
Pipes and flues	7.25 to 7.75
Railroad sheet and tank scrap	7.00 to 7.25
Railroad grate bars	7.00 to 7.50
Machine shop turnings	7.00 to 7.50

Finished Iron and Steel.—A steady increase in the aggregate demand from all sources for structural material is manifest. While the leading interest quotes $1.40, Pittsburgh, there is also evidence of $1.45 and $1.50. Deliveries are becoming the principal problem and it seems no longer a matter of price with three months delivery the general promise. Tank plates are in better demand because of increasing requirements of car plants. It is expected that the Missouri, Kansas & Texas receiver will want about 15,000 tons of standard section rails for work in Texas shortly. Light rails are more active at advanced prices, the lumber interests being particularly active. Track fastenings are in fair demand for the season. Ordinary and reinforcing bars are selling freely. Stock is moving freely out of warehouse at the following prices: Soft steel bars, 1.95c.; iron bars, 1.90c.; structural material, 2.05c.; tank plates, 2.05c.; No. 10 blue annealed sheets, 2.25c.; No. 28 black sheets, cold rolled, one pass, 2.55c.; No. 28 galvanized sheets, black sheet gage, 4c.

San Francisco

SAN FRANCISCO, CAL., Oct. 19, 1915.

Consuming demand continues light, in view of which the general sentiment is against accumulating large stocks, although increasing delay in delivery and transportation troubles make it necessary to carry more tonnage than for some months. With advancing prices, however, a fairly general movement is noted among merchants and large consumers to protect themselves as far ahead as possible, some contracts having been placed covering first quarter, and, in raw materials, even longer periods. The prospect of lower rail rates from Pittsburgh, etc., is a disturbing factor, but the effect is minimized by the expectation that the change will not take place before the end of the year. The stoppage of the Panama Canal has caused some inconvenience and resulted in some duplication of orders, but much less than would have been the case under a normal consuming demand.

Bars.—Both local open-hearth plants are now in operation, and the bar mills are running near capacity, with prospects fairly favorable for the remainder of the year, at least. Distributive trade continues rather light, but reinforcing material holds up fairly well, and considerable contracting has been done for extended delivery. New foreign business is slow to develop, but contracts have been taken for quite a heavy tonnage. The trade is limited by shipping conditions. If, as is rumored, the Panama Canal will remain closed the rest of the year, local mills will have a distinct temporary advantage on prompt-delivery business. Prices are stiffening, jobbers' carloads from the local warehouse being quoted at 2c., and from mill at 1.85c., resale prices being correspondingly higher.

Structural Material.—While few new contracts have appeared, there is said to be more work on the boards than for some time, and increased contracting is expected within the next few months. Fabricators are contracting for plain material a little more freely, but there is no inclination to put in large stocks.

Plates.—Ship construction is still about the most important factor in current requirements. Some interest is taken in the practical assurance that a number of the submarines will be built at Pacific shipyards, and the Seattle Construction & Drydock Company has taken a contract for a 5000-ton steamer. The Shell Oil Company has let additional tank contracts; and it is understood that one of the oil interests has placed contracts for quite a large tonnage, covering requirements well into the coming year.

Sheets.—Aside from a moderate seasonable movement of corrugated, there is little demand for galvanized, and black and blue annealed are very dull. The stiffening of mill prices accordingly has little effect, except to bring out a little more disposition to place contracts for extended delivery. Several mills are practically refusing to quote sheets in this market. Stocks are light, but sufficient for all current needs. Resale prices continue low.

Wrought Pipe.—Delay in arrival of oil-country goods, due to the Panama Canal slide, has caused considerable duplication of orders; but in the smaller sizes the stocks on hand, though light, are so far taking care of all requirements, and merchants are averse to increasing their supplies. The demand in connection with building is closely limited, with little indication of improvement.

Cast-Iron Pipe.—Southern California has taken a little more tonnage, Los Angeles having placed an order Oct. 8 for 1397 tons, while a water district in

Los Angeles County has taken figures on about 400 tons. The city of Pocatello, Idaho, is about to start work on a water system requiring 26 miles of pipe, but whether steel, wood or cast iron has not yet been announced. Prices remain at $31 per net ton for 6-in.; $33 for 4-in., and $1 extra for class A and gas pipe.

Pig Iron.—No further increase is noted in foundry requirements, but there has been considerable business of late in the way of extended delivery contracts, owing to the firm outlook as to prices. While no foreign iron has appeared for some time, and most of the business seems to be with Southern furnaces, some foreign iron has been placed, Hanyang being offered for October shipment at about $21.50 per gross ton. Southern foundry is firm at $22.50 to $23.

Coke.—Contracting has been fairly active the last few weeks, and many of the larger consumers are covered for six to nine months ahead, either with domestic or English coke. The latter has advanced rather sharply, Pelton Main being quoted for November sailing at $15.50 to $16 per gross ton, c.i.f. San Francisco. A good deal is said to have been shipped recently, and will be due during the spring. Prices on the various brands of domestic foundry coke used here range from $14 to $15.25 per net ton.

Old Material.—The situation in cast-iron scrap shows little change. The demand is perhaps a little more active than for the last few months, but offerings are ample and prices continue around $14 to $15 per net ton. Local dealers are asking higher prices for steel melting scrap, but, as the larger consumers are still able to pick up all they need around the country at $7 to $9 per gross ton, this may be considered the prevailing range of values.

New York

NEW YORK, Oct. 26, 1915.

Pig Iron.—Transactions have become more numerous, with buyers taking larger quantities than in the past two or three weeks. It is noteworthy that open inquiries are few, buyers being more disposed than usual to conduct negotiations quietly. The opinion is expressed by important sales agencies that within two or three weeks the present improved volume of buying will develop into quite general contracting for the first half of next year. While some foundrymen have made purchases for such delivery, few have wholly covered even their ordinary requirements. The withdrawal of furnace companies from the market, the sold-up condition of others and the diversion of furnaces from foundry to basic iron are hastening foundrymen in providing for their needs well into 1916. The Virginia Iron, Coal & Coke Company is now out of the market on No. 2 X to July 1. The Sloss-Sheffield Steel & Iron Company has no No. 2 foundry and No. 2 soft for this year. Sales in this vicinity the past week, partly for delivery this year, but more largely for the first quarter and half of 1916, include 5000 tons of malleable for New England, 1500 tons of Virginia and 1000 tons of Pennsylvania foundry iron to Connecticut, two 500-ton lots of Pennsylvania foundry to Connecticut and New Jersey and numerous smaller lots. We quote at tidewater as follows for fourth quarter delivery: No. 1 foundry, $16.50 to $17; No. 2X, $16.25 to $16.75; No. 2 plain, $15.75 to $16.25. Southern iron, $17 to $17.25 for No. 1 and $16.75 to $17 for No. 2 foundry and No. 2 soft.

Ferroalloys.—Prospects continue good for fair shipments of British ferromanganese in November, one dealer here expecting not less than 2000 tons. Receipts already in October are good under the conditions, but in no case are they likely to equal those of the second quarter of the year when about 19,000 tons came in. This contrasts with receipts of 25,000 tons per quarter under normal conditions. The bulk of this is being delivered on old merged contracts which are by no means yet filled, though some sales are being made at $100 seaboard. Domestic ferromanganese is reported selling at from $100 to $115, depending on conditions, but the quantity is not believed to be large. Spiegeleisen is in strong demand, but the unsold supply is not abundant. Sales and quotations for the high grade are reported as high as $33 and $34, furnace. Rumors that the leading producer is making arrangements to increase its spiegeleisen output could not be confirmed. Ferrosilicon, 50 per cent, is very active, the supply not being equal to the demand. It is quoted at $85 to $87, Pittsburgh.

Finished Iron and Steel.—The activity in the buying of rails, cars and bridges by railroads is an outstanding feature, and this and the advances in the price of plain material are tending to lift fabricating prices. In the last two weeks nearly 20,000 tons of bridge work has been closed, not including the 25,000 tons of elevated railroad work in Philadelphia or the 60,000 tons in Brooklyn, and in about this same time probably 18,000 cars have been bought by the railroads, representing roughly 250,000 tons of steel. The minimum quotation for shapes, plates and bars has been advanced $1 a ton to 1.50c., Pittsburgh, and bar iron has also responded with a $1 advance and is now generally quoted at 1.45c., Pittsburgh. The situation in a word is that mills are discouraging contracting for 1916, and much of the material now booked is for amounts as large if not larger than sometimes taken on contracts, but specified in the total for deliveries as rapidly as the mills can conveniently make. Some of the large buyers are covered into 1916 under contracts as usual, as mentioned in this column a few weeks ago, but the small buyer will have the same, if not aggravated, difficulties of periods of heavy demands. Some contracts of shapes for next year have been written at 1.50c., Pittsburgh, and two cases of 1000 tons of plates may be noted for the first half at 1.60c. Deliveries of plates may be obtained in 3 or 4 weeks, though some mills are filled for the year; and shapes are obtainable from 4 to 8 to 10 weeks. Of the recent structural business, the American Bridge Company has taken the major part, with the Virginia Bridge & Iron Works successful for 1500 tons for the Southern Railroad. Of the railroad car lettings in the East mention may be made of 2000 placed by the Western Maryland with the Pullman Company; 4000 cars placed by the New York Central, 1000 each to the Pullman Company and the American Car & Foundry Company, and 2000 to the Haskell & Barker Car Company, 1000 hopper cars placed by the Baltimore & Ohio with the Cambria Steel Company, and 500 additional hopper cars placed by the Philadelphia & Reading with the Standard Steel Car Company. The Louisville & Nashville has placed 1400 underframes, 400 with the Pressed Steel Car Company. For mill shipments of plates, shapes and bars we quote 1.50c., Pittsburgh, or 1.669c., Pittsburgh, and for bar iron 1.45c., Pittsburgh or 1.619c., New York. For small lots from store we quote iron and steel bars at 2.05c. to 2.10c. and plates and shapes at 2.10c. to 2.15c. Bar iron for export is quoted at 1.60c., f.a.s. New York.

Cast-Iron Pipe.—New Bedford, Mass., will open bids Nov. 4 on 971 tons of 6 to 30-in., principally 30-in. The expected purchase by Jersey City of a large quantity of flexible joint pipe has not yet come to the point of advertising for bids. Private inquiry is brisk, with more buyers coming in the market for spring shipment. Prices are firm. Carload lots of 6-in., class B and heavier, are quoted at $26 per net ton, tidewater, class A and gas pipe taking an extra of $1 per ton.

Old Material.—Steel companies and iron rolling mills are only buying whenever prices are attractive and are becoming more critical with regard to quality. Rejections are increasing. Steel axles continue in demand for export. Wrought turnings are in overabundant supply and incline to weakness. Brokers are paying about as follows to local dealers and producers, per gross ton, New York:

Old girder and T rails for melting	$12.00 to $12.25
Heavy melting steel scrap	12.00 to 12.25
Relaying rails	19.50 to 20.00
Rerolling rails	13.00 to 13.50
Iron car axles	22.00 to 22.50
Steel car axles	22.00 to 23.00
No. 1 railroad wrought	14.00 to 14.50
Wrought-iron track scrap	13.00 to 13.50
No. 1 yard wrought, long	12.75 to 13.00
No. 1 yard wrought, short	12.25 to 12.50
Light iron (nominal)	4.00 to 4.25
Cast borings	7.50 to 7.75
Wrought turnings	7.50 to 7.75
Wrought pipe	10.75 to 11.00

Foundries continue to purchase old material quite liberally. Dealers' quotations to consumers of cast scrap are as follows, per gross ton, New York:

Old car wheels	$12.00 to $12.50
No. 1 cast (machinery)	12.75 to 13.00
No. 2 cast (heavy)	11.75 to 12.00
Stove plate	9.75 to 10.00
Locomotive grate bars	9.00 to 9.50
Malleable cast (railroad)	10.00 to 10.50

Metal Market

NEW YORK, Oct. 27, 1915.

The Week's Prices

Cents Per Pound for Early Delivery

	Copper, New York			Lead		Spelter	
Oct.	Lake	Electro-lytic	Tin, New York	New York	St. Louis	New York	St. Louis
20	17.75	17.75	33.32½	4.50	4.42½	13.75	13.50
21	17.75	17.75	33.25	4.75	4.62½	14.00	13.75
22	17.75	17.75	33.25	4.75	4.62½	14.00	13.75
23	17.75	17.75	33.25	4.75	4.62½	14.00	13.75
25	17.87½	17.87½	33.50	4.75	4.62½	14.25	14.00
26	17.87½	17.87½	33.50	4.75	4.62½	14.25	14.00

Copper is a little stronger but the demand is irregular. Tin has advanced with more active buying. Lead has been quieter since the recent advance to 4.75c. Spelter is stronger following strength abroad and intermittent export buying. Antimony advanced to over 35c. in a good buying movement, but is now less active.

New York

Copper.—The business of the past week has been mostly in Lake which at prices ranging from 17.75c., cash, to 17.87½c., cash, was sold into the millions of pounds. Lake was given the preference by consumers for the reason that it was sold at the same level as electrolytic. Buyers appear to be about through, for the time being, and the market is beginning to show indications of irregularity which is helped along by the growing weakness of foreign exchange. Practically all of the buying has been on the part of war contractors or directly for export. Inquiry from the regular consuming trade continues to be quiet and the demand from the electrical industry is only fair except where war orders are in hand. Both Lake and electrolytic were quoted yesterday at 17.87½c., cash, New York, although some of the producers were asking 18c. The exports this month total 19,218 tons.

Tin.—Except on Friday a good business has been done every day, the average daily sales amounting to about 200 tons. Most of the activity was in tin afloat or future shipments from the Far East. Spot metal shared in the activity. Some of the buyers have speculated by buying on a sterling exchange basis, indicating their belief that foreign exchange will go lower. Yesterday London sterling exchange went down to 4.61½c. Cable advices from London state that there was no real basis for the report that England would impose an export tax of 10 per cent on tin. It is intimated that the report originated in this country, and now, it is said, since the suggestion has been made such a tax is not improbable. Spot tin was quoted yesterday at 33.50c. The arrivals this month total only 1975 tons and stocks will be drawn upon to make deliveries. The quantity afloat is 4025 tons.

Lead.—The leading producer advanced its price Oct. 21 from 4.50c., New York, to 4.75c. and independents followed at once. Prior to the advance there was heavy buying on the part of both foreign and domestic consumers and it was this activity, coupled with strength at London, that sent the market up. Conditions are now quieter and outside of New York there is a tendency to shade prices sufficiently to get business. The general trade in lead is good, and some of the sellers have nothing to offer for prompt shipment. Some of the export shipments have been made by way of New Orleans where ocean freight conditions are easier than they are at Atlantic ports. The New York quotation is 4.75c. and that at St. Louis, 4.62½c. The exports this month total 2721 tons.

Spelter.—In the past three or four days prompt shipment prime Western spelter has stiffened considerably and yesterday was quoted at about 14.25c., New York, and 14c., St. Louis. Spot metal is exceedingly scarce and only to be had in odd lots. Brass mill special is quoted at 15c. The London market has advanced rapidly since Oct. 20, going up £6 10s. between that day and Oct. 25. Yesterday it dropped £1. Sales for first half delivery are now being made at 13c., whereas a few weeks ago they were made at 10c. Domestic consumers hesitate to buy into next year except where they have war contracts. Immediately after the end of this year a good movement is looked for in view of the extent to which consumers have deferred buying for future needs, and producers' representatives do not foresee any substantial reductions from present price levels. The foreign demand is spasmodic. Exports this month total 5607 tons. It is not uncommon nowadays to receive a foreign inquiry, especially from Russia, for 1000 or more tons, while Japan inquires frequently also.

Antimony.—The quotations for Chinese and Japanese antimony yesterday ranged from 33.25c. to 35.75c., duty paid, having advanced in one week from 29c. There was good buying in the course of the advance, especially for export, but the market is now quiet. The general impression is that stocks will soon be increased despite the recent holdup by the Panama Canal slide of East bound shipments.

Old Metals.—The demand continues fairly good. Dealers' selling prices are unchanged as follows:

	Cents per lb.
Copper, heavy and crucible	16.75 to 17.00
Copper, heavy and wire	16.25 to 16.50
Copper, light and bottoms	14.50 to 15.00
Brass, heavy	11.75 to 12.00
Brass, light	10.00 to 10.25
Heavy machine composition	13.50 to 14.00
No. 1 yellow rod brass turnings	12.50 to 13.00
No. 1 red brass or composition turnings	12.00 to 13.00
Lead, heavy	4.25
Lead, tea	4.00
Zinc	10.50 to 11.00

Chicago

OCT. 25.—The non-ferrous metal market has pursued a generally upward trend, advances being recorded in tin, lead and spelter. Scrap metals likewise are higher. We quote: Casting copper, 17.50c.; Lake copper, 18c.; tin, carloads, 34c.; small lots, 36c.; lead, 4.70c.; spelter, nominally, 14.25c.; sheet zinc, nominally, 16c.; Cookson's antimony, 47.50c. to 50c.; other grades, 32c. On old metals we quote buying prices for less than carload lots as follows: Copper wire, crucible shapes, 14.50c.; copper bottoms, 13.50c.; copper clips, 14.25c.; red brass, 12.25c.; yellow, brass, 10.50c.; lead pipe, 4.25c.; zinc, 9.75c.; pewter, No. 1, 20c.; tinfoil, 27c.; block tin pipe, 29c.

St. Louis

OCT. 25.—Non-ferrous metals have been firm with some advances. Lead closed to-day at 4.67½c. to 4.70c.; spelter, 13.75c. to 14c.; tin, 35c.; Lake copper, 18.50c.; electrolytic copper, 18c.; Asiatic antimony, 29c. to 30c. In the Joplin ore district there was a firmer feeling with zinc blende, at $75 to $85 per ton, though some low grade sold as low as $70, while the premium grades brought as high as $88. Calamine ore was higher at $50 to $60, with premium grades running to $65. Lead ore was higher, reaching $54 for 80 per cent. Miscellaneous scrap metals are quoted as follows: Light brass, 6.50c.; heavy yellow brass, 8.50c.; heavy red brass and light copper, 10.50c.; heavy copper and copper wire, 12c.; zinc, 6.50c.; pewter, 20c.; tinfoil, 28c.; lead, 3.50c.; tea lead, 3.50c.

Tin exports from the Federated Malay States for August, 1915, were 4046 tons, as compared with 3544 tons in July, 1915, and 3591 tons in August, 1914. For the first eight months of 1915 the exports were 31,908 tons, against 33,075 tons and 32,749 tons for the same months in 1914 and 1913 respectively.

From figures furnished by express companies engaged in forwarding bullion from Alaska to the United States, the Fairbanks region has shipped this year more than $200,000 worth of antimony.

Iron and Industrial Stocks

NEW YORK, Oct. 27, 1915.

Rapid fluctuations have taken place in numerous industrial stocks since the report of a week ago. Bethlehem common continued its meteoric flight and touched 600. No other stock made anything like a proportionate advance, but quite a number rose to fresh records. Baldwin Locomotive common was among these. In a general way the market moved upward, with occasional recessions ascribed to profit taking. The renewed weakness in exchange with London was regarded with apprehension in some quarters, but had no serious effect on security values. The range of prices on active iron and industrial stocks from Wednesday of last week to Tuesday of this week was as follows:

Allis-Chal., com..	42½- 45½	Sloss, com.	59⅝- 62½
Allis-Chal., pref..	73 - 75	Pipe, com.	25 - 29¾
Am. Can, com....	63 - 64½	Pipe, pref.	45½- 50
Am. Can, pref...	106½-106⅞	U. S. Steel, com..	85¼- 87¾
Am. Car & Fdy., com.	85 - 94	U. S. Steel, pref.	115 -115½
Am. Car & Fdy., pref.	110½-116	Va. I. C. & Coke.	67⅝- 69½
Am. Loco., com..	70⅛- 74¾	West. Electric...	70⅝- 74
Am. Loco., pref.	98¼- 99½	Am. Radiator, com....	356
Am. Steel Fdries.	69½- 74	Am. Ship, com...	33¾- 35
Bald. Loco., com.	130½-154½	Am. Ship, pref.	72
Bald. Loco., pref.	109 -110½	Chic. Pneu. Tool.	86 - 88
Beth. Steel, com.	501 -600	Cambria Steel ..	66 - 69¼
Beth. Steel, pref.	163¾-184	Lake Sup. Corpn.	9⅛- 9¾
Case (J. I.), pref.....	80	Pa. Steel, com...	90 -100
Colorado Fuel...	57 - 61¼	Pa. Steel, pref...	90 - 91
General Elec....	176½-182	Warwick	10¼- 10¾
Gt. No. Ore Cert.	48⅝- 54	Crucible Stl., com	88 - 95¼
Int. Harv. of N. J., com.	109½-111⅛	Crucible Stl., pref.	107⅜-109½
Int. Harv. of N. J., pref.	109 - 117	Harb.-Walk., Refrac., com.	60
Lackawanna Stl.	83¼- 87½	Harb.-Walk., Refrac., pref..	89¾- 99
N. Y. Air Brake..	147 -153	La Belle Iron, com.	50½- 58
Nat. En. & Stm., com.	30 - 36⅛	La Belle Iron, pref.	115 -119
Nat. En. & Stm., pref.	91 - 92	Am. Brit. Mfg., com.	38 - 65
Pitts'g Steel, pref.	97 - 98	Am. Brit. Mfg., pref.	95 -130
Pressed Stl., com.	71 - 75	Can. Car & Fdry., com.	106 -109
Pressed Stl., pref.....	106	Can. Car & Fdry., pref.	119 -121
Ry. Steel Spring, com.	47¼- 50⅞	Carbon Stl., com.	100 -134
Ry. Steel Spring, pref.	94 - 96⅞	Cent. Fdry., com.	16 - 18
Republic, com. ..	53¾- 56	Cent. Fdry., pref.	33 - 35½
Republic, pref....	103¼-104¼	Dom. Steel, com.	47 - 47¾
Rumely Co., com.	4 - 5	Driggs-Seabury .	125 -143½
Rumely Co., pref.	7¼- 8¼	Midvale Steel....	91 - 98½

Dividends

The International Harvester Corporation and the International Harvester Company of New Jersey, regular quarterly, 1¾ per cent on the preferred stocks, both payable Dec. 1.

The Stewart Warner Speedometer Company, regular quarterly, 1½ per cent on the common and 1¾ on the preferred stock, both payable Nov. 1.

The National Lead Company, regular quarterly, 1¾ per cent on the preferred stock, payable Dec. 15.

The American Brass Company, regular quarterly, 1½ per cent and 1 per cent extra, payable Nov. 1.

The Dominion Bridge Company, regular quarterly, 2 per cent and 3 per cent extra, payable Nov. 15. The 2 per cent dividend places the stock again on an 8 per cent annual basis instead of 5 per cent obtaining for the past year.

The Pullman Company, regular quarterly, $2, payable Nov. 15.

The Cambria Steel Company, regular quarterly, 1¼ per cent, payable Nov. 15.

The Cleveland-Cliffs Iron Company, 2½ per cent, payable Oct. 25.

The Warwick Iron & Steel Company, 3½ per cent, payable Nov. 15.

The United States Steel Corporation, regular quarterly, 1¾ per cent on the preferred stock, payable Nov. 29. No dividend was declared on the common stock.

The United Engineering & Foundry Company has declared and paid a quarterly dividend of 1¾ per cent on its preferred stock.

The American Shipbuilding Company, Cleveland, Ohio, has taken orders for three additional boats. Two of these are for Norway, being the first boats built in Lake shipyards for a foreign country. They will be 250 ft. long. The third order was placed by H. K. Oakes, vessel agent, Cleveland, for a 600-ft. ore boat.

Jones & Laughlin Lease Furnace to Make Ferro

The Jones & Laughlin Steel Company, Pittsburgh, has leased the blast furnace of the Kittanning Iron & Steel Mfg. Company at Kittannning, Pa., until the latter part of next year and will use it for making ferromanganese. For some time the Jones & Laughlin Company has been making ferromanganese at one of its Aliquippa furnaces, but by getting control of the Kittanning furnace the Aliquippa stack will be released and give the company 500 tons more pig iron per day. The ferromanganese will be made from ore which the company has been importing from Brazil for over a year. The Kittanning stack makes about 300 tons of pig iron per day and is expected to turn out from 150 to 175 tons of ferromanganese. It will start on ferromanganese within a week or ten days.

Large Exports of Billets and Blooms to England

War exports of steel blooms, billets and slabs from the United States to Great Britain continue on a large scale, eclipsing previous experience. For September, this year, Great Britain imported from this country 36,900 gross tons against only 990 tons a year ago. For the 14 months of the war, August, 1914, to September, 1915, inclusive, Great Britain has imported from this country 298,632 tons against only 25,220 tons in the corresponding 14 months a year ago, or August, 1913, to September, 1914, inclusive.

The Steel Corporation Appeal

Announcement was made at the Department of Justice, Washington, D. C., Oct. 26, that the appeal in the case of the United States Steel Corporation will be docketed in the Supreme Court the latter part of this week. The assignment of errors in the Government's contention is almost completed, it is said, and as soon as approved by Attorney-General Gregory, will be filed. The time for the appeal in the case to expire is Nov. 10.

The Pennsylvania Steel Company is now operating its Steelton plant at nearly full steel-making capacity. Four of the five blast furnaces and the entire open-hearth department are in operation. The past week two new hydraulic presses were installed in the forging department and two more will be added in the near future. Construction work has been started on three new buildings of minor importance, comprising a carpenter shop, 40 x 80 ft., of brick; a brick storage shed, 60 x 210 ft., and a new time office, 17 ft. 6 in. x 38 ft. The recently constructed ore yard is being extended 200 ft.

The Gisholt Machine Company, Madison, Wis., is occupying the addition erected for it by the Worden-Allen Company. The building affords 25,000 sq. ft. of floor space, exclusive of the crane extension. More than 75 per cent of the walls and roof is given to lighting space. A vacuum system for dust prevention has been installed, making the sanitary conditions of the best. The building is used for cleaning all castings from the foundry. Besides this addition the Gisholt Company is rapidly occupying the buildings formerly used by the Fort Wayne Electric Works, adjoining its plant.

The National Industrial Traffic League will hold its annual meeting at the Congress Hotel, Chicago, Ill., Wednesday and Thursday, Nov. 17 and 18, the annual dinner in connection therewith to be held on Wednesday evening. The speakers at the dinner will be George T. Buckingham, president Chicago Branch, National Security League, and E. J. McVann, manager Traffic Bureau, Commercial Club, Omaha, Neb.

The Industrial Works, Bay City, Mich., has established a Philadelphia office in the Widener Building. Complete data and information can be obtained there regarding the company's line of locomotive, wrecking and freight-handling cranes, pile drivers, grab buckets, etc.

THE WAR AND NAVY PROGRAM

Proposed Expenditures for Five Years for Improving National Defenses

WASHINGTON, D. C., Oct. 26, 1915.—Interesting details of the proposed expenditures for the improvement of the national defenses have been roughly worked out by the experts of the Navy and War departments.

NAVAL BUILDING PROGRAM

Including the cost of the completion of ships previously authorized, the grand total for the five years is put at $502,482,214 by Secretary Daniels. Of this sum $95,372,127 is to be expended in the fiscal year 1917, beginning July 1 next, $110,422,750 in 1918, $96,767,500 in 1919, $95,133,087 in 1920, and $104,786,750 in 1921. The accompanying table gives some idea of the five years' program.

It is proposed to expend on aviation $2,000,000 in 1917 and $1,000,000 annually thereafter, including 1921.

Five-Years' Construction Program of United States Navy

	Dread-naughts	Battle Cruisers	Scout Cruisers	De-stroyers	Fleet Sub-marines	Coast Sub-marines	Gun-boats	Ammuni-tion Ships	Fuel Oil Ships	Repair Ships	Hospital Ship
Number	10	6	10	50	15	85	4	2	2	1	1
Displacement, each, tons.	33,000	31,000	8,000	1,100	1,000	500	1,600	....	12,500	7,500	6,000
Cost, each...	$18,800,000	$17,500,000	$5,000,000	$1,360,000	$1,500,000	$650,000	$760,000	....	$1,355,000	$2,000,000	$2,450,000
Plates and shapes, each, tons	11,000	9,600	2,400	500	450	235	525	3,300	4,150	2,500	....
Machinery, each, tons..	11,550	12,800	4,000	560	500	250	675	6,700	8,350	5,000	....
Armor, each, tons	8,800	8,000	1,200	...	...	...	...	....	....	....	....
Armament, tons	1,650	1,300	400	40	50	15	400	....	....	....	....

For reserve stores of munitions $8,000,000 is to be expended in 1917, $5,000,000 annually in 1918, 1919 and 1920, and $2,000,000 in 1921.

The new construction will represent approximately 265,000 tons of plates and shapes, 331,000 tons of machinery and other fittings, 148,000 tons of armor and 35,000 tons of armament. In estimating the cost of this material the naval experts have assumed that prices in 1917 and possibly for a year or two thereafter will be 10 to 15 per cent above those paid in 1915, owing to the great demand for material caused by the war in Europe.

At the present time the Navy Department contracts for nearly two-thirds of the guns required for warship batteries. With the aid of the Watervliet arsenal of the War Department, which makes a few small guns for the navy, it manufactures about one-third of current requirements. At the Washington gun foundry it is equipped to produce forgings and finished guns of all sizes, but it also purchases forgings which are machined in the Washington gun shops. The 16-in. rifles used in the turrets of the dreadnaughts are estimated to cost about $110,000 each.

To provide men to man the ships, Secretary Daniels has recommended an increase of 7500 sailors, 2500 apprentice seamen and 1500 marines, or 11,500 men in all. This number, it is estimated, will enable the department to keep in full commission all battleships under 15 years of age, all destroyers and submarines under 12 years of age, one-half the existing number of cruisers, all the gunboats and the necessary auxiliaries for the fleet, as well as to provide adequate reserve complements for the remaining vessels of military value and for the shore stations.

WAR MATERIAL FOR THE ARMY

While Secretary Garrison's program to increase the military establishment has not been formally made public, certain of its most important features can be authoritatively stated. Like the Secretary of the Navy, the Secretary of War has framed a continuing program. It will cover a period of four years and will call for an annual expenditure of $26,000,000 for the accumulation of reserve material and of $20,000,000 for the coast defenses, a total of $184,000,000 for the four-year period. These expenditures are additional, of course, to the proposed increase in the appropriations for personnel and for the current work of the department.

The War Department now buys of private contractors nearly all its heavy gun forgings and the bulk of the forgings for the field artillery. At present only two companies are making these forgings and it is understood that they are the only concerns in shape to do so, either because of equipment or on account of other engagements. The War Department machines forgings at the Watervliet arsenal, the capacity of which is understood to be equal to the increased output for several years to come. The 16-in. rifles for seacoast defense cost the Government about $100,000 each. The carriages for these guns, which also cost about $100,000 each, are now being built at Watertown and constitute the chief output of that arsenal, the equipment of which is understood to be equal to any demands that might be made upon it under the department's new program. The Government has sufficient capacity at the Frankford arsenal and elsewhere to produce all the fixed ammunition for small arms that Congress is likely to provide for.

A likely development in harbor defense, if Congress supplies the money, is the construction of nets of heavy steel cables intended to obstruct and entangle submarines, torpedoes, floating mines, etc.

CAPACITY OF MUNITION FACTORIES EXCEEDS GOVERNMENT NEEDS

In default of specific legislation on the subject, it is probable that the greater part of the material, which the War Department will purchase from private contractors under the new program, will consist of shells and shrapnel ranging in size from 2.95 to 6 in. This material was covered by the general drawing and description which appeared in THE IRON AGE, Aug. 12, 1915. The department has learned that the capacity of the munitions factories in this country is many times larger than any possible demand the Government is likely to make upon them.

LARGE CALIBER FIELD GUNS

Should Congress grant the appropriation estimated for by Secretary Garrison the department would at once undertake the construction of field guns of larger caliber than those heretofore built and will thus seek to profit by the experience of the fighting armies of Europe. This development will no doubt be followed by a demand for shells and shrapnel of much larger sizes than those heretofore used and a large part of this new material will probably be purchased by contract.

As was expected, Secretary Daniels has coupled the publication of his program for new naval construction with an appeal in behalf of a Government armor factory. To this he has added a recommendation for a projectile factory which he frankly states is intended to render the department entirely independent of private manufacturers. At the present time the Government is manufacturing 3-in. and 6-in. shells in the navy yards at Mare Island, Charleston and Norfolk, and if Congress approves the secretary states he will erect a factory which will turn out a large product of 14-in. armor-piercing shells as well as smaller projectiles, "thus insuring better shells and better competition."

W. L. C.

American Iron and Steel Institute

(Continued from page 1005)

e done two or three times a year. The largest cost em is the fuel, although we have been able to decrease to some extent by preheating the combustion air and by localizing the zone of combustion through modifiation of the burner. The best remedy, however, is pparently the Downs tuyere process, which forces air nder pressure through the shifting bed of materials ear the end of the kiln, and thereby burns out the carbon, thus utilizing its heat in a similar manner, as is done in the down-draft process.

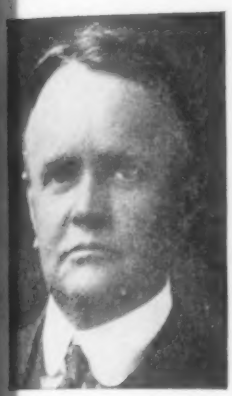
MATERIALS FOR SINTERING

Among the fine materials to be considered for sintering those naturally have been chosen first which were present at the blast furnace and steel plants, and had to be disposed of. Next will come such fines which are produced as heads or are now wasted in the tailings in the various wet or dry processes of ore beneficiation, and finally the sintering of a portion of the ores themselves must be considered.

As a material of the first class the sediment from the discharge of our gas washers demands our special attention. This so-called pond sludge is of the greatest physical fineness, is sufficiently high in iron, and on account of its uniform composition should lend itself well to admixture with flue dust.

Under-Advertising of the Steel Business*

BY GEORGE H. JONES



GEORGE H. JONES
Vice-president and general manager of sales, Inland Steel Company, Chicago.

ENGLAND has raised the greater part of an army of four millions by advertising, using newspapers, billboards, omnibuses and other methods. This was considered the most effective way and its application is almost universal.

This is an object lesson to the iron and steel manufacturers who have been in the habit of saying about advertising, "When the demand for our products is good there is no need for it, and when the demand is poor there is no use of it."

The steel manufacturers can pave the way to make depressions less severe by stimulating a demand for the products of the steel mills. The way many of us advertise is to place what amounts to a business card in a trade paper and let it go at that. It will do once in a while to call attention to a full list of our products, but it posseses little sales value. We want our advertisements to be read. We must, therefore, give truthful information of value to a prospective customer, and whenever possible the matter should be well illustrated. One product only should be treated in one advertisement. Sizes, quality, capacity and other special advantages we have to offer should be stated and enlarged upon. We should answer the readers' questions before they are asked.

ADVERTISING AGENCIES

Very few of those who have advertising in charge have the time or inclination to do this work properly. It requires much watchful detail work, knowledge of the printer's art and getting the copy to the publication at the proper time and *ready* for printing. An advertising agency can do this well at a comparatively small cost and it brings in a trained mind and another viewpoint. When you consider what you pay annually to the publications in which you advertise and the aggregate of all, it is worth the small extra percentage which it costs to have much of the work done by an expert.

Trade and technical periodicals must not be neglected in making out an advertising program. A certain amount of general publicity is also necessary, and the public must be informed of the merits of any special product, in order that a demand be created for it, without which the dealer and manufacturer would not ask for it. Pamphlets, booklets, folders, cards, circulars and letters can be successfully used. The personal call is often necessary and the outdoor field could be used to advantage. Catalogs that give some real information and explanations are badly needed. Too often they only represent the mill man's viewpoint and give the buyer very little of the facts and figures he needs. Catalogs are recommened to be of uniform size—8½ x 11 in. and preferably issued in separate divisions covering kindred products.

CREATING DEMAND FOR STEEL PRODUCTS

The use of structural steel is due to a demand for it rather than to any effort made by the steel manufacturers to introduce its use. But steel bars for reinforcing concrete are required in the main as a substitute for other than steel construction because the cement manufacturers and the concerns controlling patented bars promoted a large use for their products and in doing so these bars came into being, in spite of rather than because of the steel makers themselves. The tonnage of concrete bars now made by steel manufacturers is of considerable importance to the industry.

The Association of Sheet and Tin Plate Manufacturers last year started a bureau of development which promised well, but it did not materialize owing to the "penny-wise and pound-foolish" ideas of many of those to whom it should have appealed and who were invited to co-operate. Not enough subscriptions were received to justify them in going ahead with the very full and comprehensive program outlined in their "Memorandum of Plans."

EXAMPLE SET BY LUMBERMEN

About six years ago five men in the south each put up $260 into a fund to advertise red gum in an architectural journal, after dint of much hard work on the part of a representative of that journal.

Though they were men of wealth, this $260 came hard because they really did not believe that anything would come of it.

But the result of that $1,300 venture was the sale of red gum aggregating $350,000 with three successive $2 jumps in price per 1000 ft. in a single year. This campaign has continued year after year, as high as $40,000 a year being spent in it. The result is the widespread use of red gum wood for fancy interior finish—a wood that had previously been in the railroad tie class.

This campaign started the Southern Cypress Association into action, and their annual advertising expenditure far exceeds that of the Red Gum Association.

Then came the North Carolina Pine Association, the Northern Pine Association, the West Coast Lumber Manufacturers' Association, the California Redwood Association and, last and largest of all, the Southern Yellow Pine Association. There is now talk of an amalgamation between all their interests for the purpose of financing a mammoth campaign in favor of wood as against substitutes for wood.

Let us acknowledge that, as a class, the steel industries of the country are the most clumsily and inadequately advertised of all our industries. I almost feel safe in saying that more advertising money has been spent in *tooth paste* than all of us combined have expended in all of our products. And our total expenditure would look like small change beside the bank

*Paper is printed substantially in full.

W. U. Follansbee, Follansbee Brothers Company, at Left; Harry D. Jones, Manager United Steel Company, Canton, Ohio, at Right

roll expended annually by the chewing-gum profession, the soap artists or the baking-powder family. Yet steel products as a group are just as susceptible to the power of publicity as any of these, because just as universal in consumption and vastly more important to the public welfare.

NEW FIELDS FOR STEEL PRODUCTS

Similarly, an educational campaign on steel products will not only serve to protect us against the onslaughts against us made by various substitute products, but it will lead to a great total increase in building operations. Just one case in point: A million farmers now leave their implements out in the fields all winter unprotected by any shelter—steel, wood, paper or otherwise. Our duty to ourselves and to the farmers is to stop this ruinous loss by first showing them their folly, and then giving them practical instruction in the way of stopping that loss by erecting sheet steel shelters.

Another instance: Cash wheat at harvest time averages some cents per bushel lower than its selling price in mid-winter or early spring. This is simply because farmers, with no place to store their wheat, sell it to the local elevators at whatever price they offer. Our duty is to show the farmers how they can vastly increase their earnings by erecting inexpensive steel grain houses and storing their grain on their own farms until demand has caught up with the supply.

Still another typical example: Shelters at cross-road stops of interurban trolley lines. The right sort of an educational campaign will show these roads how they can increase their traffic by providing this comfort; and if they don't do so, such a campaign will wake up the farming public to demanding it.

No doubt hundreds of other fields lie open to us if we will but learn the vital necessity of harnessing the vast willing and responsive power of educational publicity. The same sort of organized publicity has been done with other products, among which may be mentioned electrical machinery and equipment, gas making machinery, etc.

FIRE PREVENTION

The Association of Sheet and Tin Plate Manufacturers in April, 1914, issued a pamphlet entitled, "A Discussion of Fire Prevention in Its Bearing Upon the Use of Non-Inflammable Materials."

It is reported there are 6,000,000 farms in the United States, 10 per cent of which use metal roofing and 30 per cent patented (not metal), and the remainder generally shingles, with perhaps a few tile and slate roofs. This condition can be changed by proper promotion work and patented roofing largely supplemented by sheet steel and tin. Some good work has been done along these lines, but not enough to make much of an impression. The question of fire and lightning comes in here. The perils of combustible roofs are well known, but often forgotten. They should constantly be kept before the owners of farm and other buildings.

The manufacturers of patented roofings, more or less inflammable, spend large sums annually running into the hundreds of thousands of dollars in advertising their goods and have been successful in getting them used, to our disadvantage.

Advertising has made the use of patented roofs possible and the mail-order houses have been liberal and consistent helpers. These feltless "felt" and rubberless "rubber," inflammable, "fireproof" roofs have very little excuse for existence and metal roofing should take their place, besides encroaching largely into the percentage of shingles.

The National Hardware Association this year offered prizes for the best essays on "What Constitutes a Good Roof," from the standpoint of metal roofing. The three best essays have been printed in a booklet which is given a large circulation. This is a step in the right direction.

One phase in the extension of the sale of many of our products is the education of both wholesale and retail merchants, especially the retailers and their clerks.

By making them better steel salesmen we can multiply their sales. This is of vast importance because the aggregate tonnage of steel and steel articles sold to the consuming public through retail sources is exceedingly great.

Lumber dealers are now selling steel fencing, steel fence posts and steel roofing. It is not natural for them to do this, but they are merchants first and lumber dealers afterward. They are, therefore, selling what is asked for, and we can help them materially to increase their sales of our products. Modern saw-mills, interested only in the production of lumber in its various forms, are using steel roofing, and in doing so they admit it has advantages over their own product. It is fireproof, lightning-proof when properly grounded, and will last longer when taken care of than any of the materials heretofore used.

FIELD FOR PROMOTION OF STEEL SALES

Promotion and sales work—comprehensive and extensive—is needed to further the use of steel in the following directions:

Roofing and siding of proper weight in place of patented materials.

Fence posts for railroads, farms, vineyards and other uses. There are probably fifteen to twenty concerns now making steel fence posts and they are commencing to do well, but the possibilities in this line have hardly been touched upon. In bolts—on account of the greater tensile strength and uniformity of structure. In many lines of work steel has come into its own and may be safely left as it is, but steel could be used in smaller sizes, giving equal strength and less weight, in the following items among others:

Metal Shingles
Metal Ceilings
Steel Lath
Steel Fire Doors
Steel Window Frames
Steel Lockers
Steel Culverts
Steel School Furniture
Steel Office Furniture
Steel Shelving
Steel Barrels
Steel Kegs
Steel Crates
Steel Packing Boxes
Steel Telegraph Poles
Steel Telephone Poles
Steel Railroad Ties
Steel Cattle Guards
Steel Wagon Bodies and Seats
Steel Wagon Tongues
Steel Double Trees and Single Trees
Steel Hay Racks
Steel Barns
Steel Hog Houses
Steel Chicken Houses
Steel Implement Sheds
Steel Grain Bins
Steel Corn Cribs
Steel Fruit Picking Stands
Steel Ladders
Steel Scaffolding
Steel Warehouses
Steel Warehouse Boxes
Steel Boat Houses
Steel Storage Buildings
Steel Shops
Steel Tool Houses
Steel Foundries
Steel Repair Shops
Steel Section Houses
Steel Oil Houses
Steel Gasoline Depots
Steel Garages
Steel Real Estate Offices
Steel Labor Dormitories
Steel Sectional Buildings, for factory extensions, and other purposes.
Steel corrugated sheets for tight fences
Steel frame work for small buildings
Steel Tanks
Steel Silos
Steel Boats
Steel Barges
Steel Burial Caskets
Steel frames and boards for standing signs
Steel for mine, timbering and tipple work for main and outbuildings

CO-OPERATION OF STEEL MEN

Development work covering an increase in the use of steel in the various directions in which it could be employed to advantage, might be well undertaken by all steel manufacturers and through them by their customers under the direction of a bureau of publicity and promotion of the American Iron and Steel Institute. This bureau, acting for the interests of the steel business at large and not handicapped by being confined to the product of any one concern, would be on the watch to determine in what way steel could be substituted for other materials and be prepared to offer suggestions as to the best means to secure the results aimed at. The Institute being recognized as a responsible and authentic institution, could not afford to disseminate inaccurate or unreliable information, nor would it be suspected of doing so. It would be incumbent upon the steel manufacturers to carry out the standards recommended by the Institute and not cater to the demand for underweight and cheapened material.

A series of handbooks on steel and its advantages, issued in sufficient quantities, under the auspices of the Institute and sold to its members at cost, for their distribution to the merchants with whom they deal would be most effective.

The farms of this country offer a vast undeveloped market for a great variety of steel products. A concerted campaign by this Institute, in the influential farm journals, would bring very satisfactory results. This campaign might take the form of offering to the farmers their choice of booklets on certain farm buildings, as for instance silos, implement sheds, roofs, etc.

Such a campaign would involve the expenditure of a large sum in the aggregate, but the share of each member participating would not be burdensome.

I have made no mention of the possibilities in the export business, the exploiting of which is in a class by itself and should be treated separately by one experienced in that particular work.

The Inspections and Entertainment of Saturday

Saturday morning was spent in visiting the plant of the White Company, maker of automobiles and motor trucks, and the ore docks and unloading plant of the Pennsylvania Railroad Company on the Lake front in Cleveland.

The party left the Statler Hotel at 9 o'clock, going in automobiles directly to the plant of the White Company, where considerable time was spent in inspecting the various manufacturing, testing and assembling departments. The visitors had an opportunity to see some of the large motor trucks that are being built for export to Europe for war use. A special train was provided on the New York Central Railroad for taking the visitors from the White plant to the ore docks, the cars being boarded on a switch track adjoining the plant.

A quick ride was made to the ore handling plant on the opposite side of the city, the visitors stepping from the train to the dock a few feet from the unloading equipment. Here an opportunity was given them to see the unloading of a modern steel ore boat by one of the largest and most up-to-date ore unloading plants on the Great Lakes. The boat was the J. Pierpont Morgan, one of the vessels of the Pittsburgh Steel Company's fleet, which is one of twenty-one boats of about the same size belonging to the Steel Corporation.

The Morgan is a 600-ft. boat with an ore carrying capacity of over 11,500 tons. The visitors climbed aboard the boat and from the deck watched with great interest the giant arms of the four Hulett unloaders as they reached down into the hold of the vessel and scooped up the ore from the bottom of the boat. These unloaders are equipped with 17½ ton buckets and have a capacity of 3000 tons per hour in unloading a modern vessel. In the past summer they made a record of unloading the steamer James A. Farrell with a cargo of 1183 gross tons in 3 hr. and 35 min., the vessel being tied to the docks only 3 hr. and 40 min. This plant has a record of loading in one day 1030 cars of ore. While the plant was being inspected, the ore was unloaded direct to the railroad cars from hoppers into which it was dumped by the buckets. Cars on the tracks beneath are spotted under the hoppers by electric locomotives.

After inspecting the ore handling plant the party again boarded the train and was taken to the club house of the Country Club. During this short trip back across the city a buffet luncheon was served in a car provided for that purpose and there was luncheon waiting at the Country Club. Many of the visitors enjoyed the privileges of the club's golf course during the remainder of the afternoon. Other golf clubs were also open to the members, and a large number of Cleveland companies

From Left to Right: B. F. Bourne, Bourne-Fuller Company, Cleveland; H. G. Dalton, Pickands, Mather & Co., Walter White, White Company, Cleveland; Julian Kennedy, Pittsburgh; Windsor White, White Company; Clarence H. Howard, President Commonwealth Steel Company, St. Louis

James T. McCleary, Secretary American Iron and Steel Institute, New York

invited the members of the Institute to visit their plants.

Directors' Meeting Creates the "Youngstown District"

The usual meeting of the Institute directors was held at the noon intermission. The important action taken was the creation of the "Youngstown district" as successor, in the Institute's statistical designations, to "Mahoning and Shenango Valleys." For some time iron and steel manufacturers of Youngstown and vicinity have contended that the Youngstown district was entitled to appear in the statistics under its own name, as there are now the "Pittsburgh district" and "Chicago district." The matter was presented at the directors' meeting and it was decided that the statistics of production which for many years have appeared under the designation "Mahoning and Shenango Valleys" shall appear hereafter in the official publications as the output of the "Youngstown district." This will include Sharon, New Castle, Sharpsville and West Middlesex in the Shenango Valley and Youngstown, Girard, Hubbard, Niles, Lowellville and other points in the Mahoning Valley. As indicating the relative importance of the "Valleys"—or the Youngstown district as they will hereafter be known—and the Pittsburgh and Chicago districts the following statement was made at the meetings of the pig iron production for 1913 and 1914, in gross tons:

	1913	1914
Allegheny County	5,999,539	4,665,893
Youngstown District	5,276,663	3,793,789
Chicago District	4,703,715	3,404,806
United States	30,966,152	23,332,244

The steel ingot statistics for 1913 made the following showing:

Allegheny County	7,669,221
Youngstown District (Mahoning Valley, 2,911,266; Shenango Valley, 1,871,773)	4,783,039
Indiana and Illinois	4,940,984
United States	31,251,303

The absences from the directors' meeting were conspicuous on this occasion. Among those who have almost invariably attended, but were missed at Cleveland, were C. M. Schwab, E. C. Felton, E. A. S. Clarke, William A. Rogers and William H. Donner.

War Comment Features Banquet

The Institute banquet was the most largely attended of any held thus far and overflowed the accommodations provided. The brief addresses of the evening were preceded by a display of moving picture films covering wire and fence making and the manufacture of tubing and the welfare work of the National Tube Company.

Judge Gary gave the impression that speakers little accustomed to the experience of public effort were to be called upon but the evidence proved all to the contrary. Ralph H. Sweetser, the Thomas Iron Company, told in a delightful way what his company had accomplished through advertising its pig iron. Daniel B. Meecham, Rogers, Brown & Co., supplemented the showing of the welfare films with an indorsement of what is being accomplished through welfare work. For welfare equipment alone, he said, corporations have within a recent period spent over $1,750,000.

William S. Horner, the American Rolling Mill Company, presented himself as a representative of the sales department, and remarked that were the operating departments continuously guilty of blunders of the magnitude made by the sales departments, bankruptcy would be a not uncommon lot. Julian Kennedy brought forth spontaneous applause when he said, "There is not a gentleman in this room who would not stop this war in an instant, regardless of the possible profit in its continuance." Colonel Bope, vice-president Carnegie Steel Company, tactfully contradicted both Mr. Horner and Mr. Kennedy. Clarence H. Howard, president the Commonwealth Steel Company, emphasized the fact that welfare work comprehends something given to the employee by the employer, while fellowship represents a working together in mutual helpfulness of employer and employee toward common ends. Skill, as it is being taught to the employees of his company, he said, "Is doing the right thing the first time."

William G. Palmer, president American Steel & Wire Company decried what he termed "weak-kneed" practices of selling, which, under the slightest pressure, gave the advantage to the buyer. James Inglis, president American Blower Company, referred to the new Ford hospital at Detroit.

In response to calls from the floor, Joseph G. Butler, Jr., James H. Hoyt, James A. Farrell and Willis King responded at some length.

BRITISH STEEL EXPORTS

September Figures Reflect a Decline—Steel-Bar Exports the Largest

The possibility of an embargo by Great Britain on exports of iron and steel, contained in our cable last week, lends special interest to that country's exports for September. Official data, just published, show that last month's exports of iron and steel, excluding iron ore and scrap, were 245,853 gross tons, compared with 345,661 tons in July and 292,513 in August—a constant decline since July. In September, 1914, the total was 225,463 tons, so that last month was but little in excess of the second month of the war. For the nine months to Oct. 1, the total was 2,233,529 tons, against 3,179,726 tons to Oct. 1, 1914, a decrease of 43 per cent. Export values were £33,976,229 and £28,794,063 respectively for the nine-month periods of 1914 and 1915.

Pig-iron exports to Oct. 1, 1915, were 298,359 tons, against 562,772 tons to Oct. 1, 1914, a decrease of 47.2 per cent. Italy took 19,457 tons; Holland, 5218 tons, and Sweden, 2580 tons of the September exports.

Steel-bar exports maintain the larger expansion. For September, 1915, they were 35,853 tons, against 12,868 tons in September, 1914. France took 26,312 tons last month, against only 20 tons in September, 1914. Total steel-bar exports for the first nine months of this year were 343,647 tons (France taking 237,556 tons) against a total of 152,376 tons to Oct. 1, 1914, or more than double.

Galvanized sheet exports continue low. For the first nine months of this year they were 250,389 tons, or 51 per cent less than a year ago, the exports to Oct. 1, 1915 and 1914, being 238,480 tons and 488,869 tons respectively.

Ferromanganese exports in September, 1915, were about 6500 tons, compared with 13,500 tons in September, 1914. To Oct. 1, 1915, they were about 73,000 tons, comparing with 89,000 tons to Oct. 1, 1914. Manganese-ore imports in September were 45,045 tons, against 50,435 tons in September, 1914. To Oct. 1, 1915, they were only 209,814 tons, against 409,765 tons to Oct. 1, 1914, a decrease of 48.7 per cent.

Rail exports were 15,800 tons last month, against 39,185 tons in September, 1914. For the first nine months of this year they were only 205,952 tons, against 365,939 tons to Oct. 1, 1914.

British imports of iron and steel, apart from iron ore and scrap, in September, 1915, were 134,713 tons. In August they were 120,863 tons and in July, 134,444 tons. In September, 1914, they were only 39,298 tons. For nine months to Oct. 1, 1915, the imports were 901,032 tons, against 1,467,412 tons to Oct. 1, 1914, a decrease of about 38 per cent.

Iron-ore imports continue favorable, showing an increase over last year, being 4,709,046 tons to Oct. 1, 1915, against 4,527,776 tons for the same period last year.

Imports of crude zinc were 6432 tons in September this year, against 13,534 tons in September, 1914. For the nine months to Oct. 1, 1915, they were 62,481 tons, against 46,411 tons to Oct. 1, 1914.

The first 100 tons of steel rails has been produced by the Broken Hill Proprietary Company's new plant at Newcastle, N. S. W. Delivery was made at the end of July with 1500 tons following the next week. They are part of a large order for the Home Affairs Department.

Frederick W. Taylor's Memory Honored

Memorial Meeting of the Society to Promote the Science of Management—Notable Tributes from Former Associates and from Foreign Lands

Upward of 500 men and women gathered in Philadelphia to pay tribute to the memory of Frederick W. Taylor on Friday and Saturday, Oct. 22 and 23. The occasion was a memorial meeting held under the auspices of the Society to Promote the Science of Management, of which Mr. Taylor was an honorary member. Memorial services were held in the chapel at Houston Hall of the University of Pennsylvania; at Boxly, Mr. Taylor's home in Chestnut Hill, Philadelphia, and at Mr. Taylor's grave in West Laurel Hill Cemetery.

The program at the memorial service in Houston Hall originally had included tributes from men in foreign lands who had been associated with or deeply influenced by Mr. Taylor's teachings. Unfortunately conditions arising from the war made it impossible to obtain tributes from all of those who had earlier signified their intention of contributing to the meeting, and in addition many of the tributes which did arrive from foreign countries were of a more or less fragmentary character, due to the censorship and other circumstances connected with the derangement of the postal service. Nevertheless, tributes were received from Henri Le Chatelier and Charles de Freminville of Paris, and A. Wallichs of the Royal Polytechnical School, Aix-La-Chapelle, and also one from the director of the technical school at Helsingfors, Finland.

The memorial service was opened by Edgar F. Smith, provost of the University of Pennsylvania, who recalled that in the same hall ten years ago, almost to the very day, the University had conferred on Mr. Taylor the degree of Doctor of Science in recognition of the services he had contributed to the advancement of science and industry. Following Mr. Smith, Rudolph Blankenburg, mayor of Philadelphia, Mr. Taylor's home town, called attention to the fact that there were few monuments erected in bronze or marble for the achievements of men of peace, but that Frederick Winslow Taylor needed no such monument. He told how, when he was elected mayor, he had requested Mr. Taylor to assume the duties of director of public works of the city of Philadelphia. Mr. Taylor considered the question long and earnestly, and then declined only on the ground that his health would not permit his assuming the burdens of that office. He, however, recommended one of his associates, Morris L. Cooke, who, he said, has filled the position to his entire satisfaction.

TRIBUTES FROM FOREIGN LANDS

Following Mayor Blankenburg, Col. Vignal, military attaché of the French Embassy, read an appreciation of the work of Taylor prepared by M. Le Chatelier. M. Le Chatelier told of the progress of Mr. Taylor's work in France. He said:

> There is not to my knowledge a single one of our factories which has been entirely reorganized by the installation of the principles of scientific management. I know only half a dozen where partial applications have been attempted. On the other hand there has certainly been brought about a widespread stimulation of ideas in the industrial world. To-day Frederick Taylor's ideas are familiar to the majority of French engineers. Whether they will or not they necessarily exercise an influence on every one of their decisions. * * * I had warned Frederick Taylor that in France his system would take the name of the engineers or the firms which would put his ideas into practice. "I desire nothing more," said he, "so that my ideas spread, it matters little the dress under which they circulate." * * *
>
> Frederick Taylor's ideas are making their way little by little. Machinery was forced upon industry despite of the attacks of which it was the object. It will be the same with the scientific principles of management of work. From certain points of view their successes will be even easier because ideas have a far greater force of penetration and of diffusion than material objects. One can break up machinery, burn down shops, but there is no way of coercing ideas."

From Professor Wallichs came the following:

> When I first became acquainted with Taylor's doctrine I was surprised that these ideas originated in America and not in Germany, because the admirable thoroughness, the great perseverance with which Taylor pursued his goal, the almost arbitrary rules covering all apparently unimportant details and processes, the analyzing and observing one by one of all the activities and motions, are phenomena which are more characteristic of the German than the American people.
>
> This war-torn world of ours has indeed lost a great leader at a time when it needed him most. It would seem that when the moment comes to bind up humanity's wounds, the creed which Frederick Winslow Taylor lived and died to establish may prove our rock upon which we may build a more lasting peace.

THE MEN WHO WORKED WITH TAYLOR

Three men who were intimately associated with Mr. Taylor during the development of his system of management were Henry L. Gantt, Sanford E. Thompson and Carl G. Barth. These three men next told of their personal experiences during the years they were associated with Mr. Taylor and gave interesting observations on his many-sided character. One noticeable characteristic of Mr. Taylor was his insistence that everything be carried out in exact accordance with the detailed instructions given by him. The following excerpt from Mr. Thompson's address illustrates this point:

> There stands out vividly in my mind an occasion some 25 years ago when a messenger pulled me out of bed at 3 o'clock one winter morning to go down to the pulp mill. I was there met by Mr. Taylor. "Mr. Thompson, I told you to have an idler built and placed on every belt in this mill. Why was this not done? I don't want any excuses. I won't have any excuses. Why was it not done?" This was one of my first lessons in the training which every man received who came under Mr. Taylor's direction in those days.

Mr. Taylor's name is possibly most widely known as the discoverer, in conjunction with Maunsel White, of high-speed steel. This feat at once stamps him as a metallurgist of the first rank. In addition he was an engineer of the highest order. Speaking on this phase of his activities, Mr. Gantt said:

> It seems quite likely that if he had adhered to what was then known as strictly engineering he would have made even a greater reputation than he achieved in the field of management. The least heard of, but to my mind his most daring feat, was his design of the great hammer of the Midvale Steel Company, which was kept in its alignment by the elasticity of its parts which yielded to the force of a blow and returned exactly to their former position. Dependence upon the principle of elasticity enabled him to build a hammer which for its weight had far greater power than any other hammer that had ever been built. All previous hammers of this class had been designed to keep their alignment by great mass and stiffness and it took a bold man to throw aside precedent when the stake was such a large one. I do not know of any more daring or successful piece of engineering construction.

The period from the time he left Midvale until he completed his work at South Bethlehem was probably the most important period of Mr. Taylor's career. It was during this period that he developed the principles which have been designated and accepted as scientific management. Said Mr. Thompson:

> Coming from Midvale we recognize the competent, hustling, able, inventive engineer. In his notable paper a piece rate system read before the Mechanical Engineers in 1895 we find the first presentation of what he then termed "Elementary Rate Fixing"; that is, the determination of the proper time

for doing a piece of work by unit time study, but we find in this paper scarcely a reference to the broader subject of management or scientific standardization.

In his paper "Notes on Belting," however, presented two years earlier the principles of standardization and of scientific research are clearly brought out in the development of definite lines and of a definite system for handling the complex problem of belting—the adoption of the scientific method, the method of which eliminates from a test all variables but one, the method which develops a problem step by step to the attainment of definite laws. Not until the publication of 'Shop Management" in 1903 is the development of the complete system, based not on theory, not on opinion but as a result of this broad experience in operation gained by his contact with manufacturing plants all over the country.

THE PERSONAL SIDE OF TAYLOR

Not the least interesting side of Taylor was his personal relations with those who knew him well. To them he was not the taskmaster, the driver that he was commonly believed to be, but the warm, kind-hearted, generous man who made the troubles of his friends his own. Speaking on his personal characteristics Mr. Gantt said:

If I were asked to point out his most prominent characteristic, I should say that it was his ability to prosecute the task he had set himself regardless of the lack of sympathy of his friends and criticism of his enemies. Having determined on a course of action he pursued it regardless of consequences and inasmuch as such courses were planned by a clear head and followed with an iron will, he often accomplished results far in excess of what even his most earnest supporters thought possible. To end here would not complete our picture. He was not the steam roller that some people like to represent him, but he did believe that a strenuous life was a life worth while and not only brought more financial compensation but added to the usefulness and happiness of man. He had still another system. People said he made work of his play. True, work was his joy; not routine that could be done by anybody, but the work that others had been unable to do. An unsolved problem was a constant challenge to him and he attacked it with a thoroughness and eagerness that it is hard to comprehend.

THE FUTURE OF TAYLOR'S WORK

Louis D. Brandeis looked forward into the future when he spoke on the effect of scientific management upon social and economic progress. Mr. Brandeis dealt specifically with the relation of Mr. Taylor's work to organized labor and summed up Taylor's aims and ideals in the epigrammatic expression, "the laborer is worthy of his hire and the hire is worthy of the laborer." He called attention to the fact that the ideals of Taylor and the aims of the labor men were one and the same thing, namely, the attainment of shorter working hours, the highest possible wage for the workmen, the postponement of the working period so that the workmen's children would have more time for schooling and for pleasure before taking up life's burdens. The establishment of better working conditions was an ideal of Taylor and an accomplished fact in those plants where he had had full sway. The attainment of an industrial democracy is the ideal of the labor men. The methods of Taylor will lead to this if the labor men will only see it. When scientific management obtains the consent and co-operation of organized labor then will capital and labor go hand in hand toward the end desired by both.

EXPERIMENTS IN GRASS GROWING

Of peculiar interest was the visit to Mr. Taylor's home at Boxly. Here were on exhibition records, scrap books and implements used by Mr. Taylor in his work. Here also were conducted his famous grass growing experiments which enabled him in a few months to produce lawns equal to the best lawns of England which had required 200 years for their final perfection. In his experiments on the growing of grass Mr. Taylor pursued the same rigid scientific methods as he had used when he discovered high speed steel and it is but another illustration of his versatility that he was able to make himself a master in such widely diverse industries as metallurgy and gardening. In connection with these experiments Harold Van Du Zee, who for 13 years had been associated with Mr. Taylor on his grass experiments, addressed the members and guests, describing the methods that had been followed.

THE WORK FOR THE NAVY

It is a fact that was known to but probably not over a dozen people and which was revealed for the first time during the exercises at Boxly that Mr. Taylor had rendered exceptional service to the Government of the United States in the reorganization of the navy yards of the country. Rear-Admiral C. F. Goodrich, who at the time was commandant of the Brooklyn Navy Yard, related his experience with Mr. Taylor. He told how when he took charge he found the navy yard in a chaos of inefficiency, and how, having got the support of the then assistant secretary of the Navy, Truman Newbery, in his effort to reorganize and improve conditions, he went to Mr. Taylor for advice. He told how Mr. Taylor consented to guide them in their effort to improve conditions and related how he in his characteristic manner made it plain that he was giving his advice, time and energy freely for the benefit of the country and from motives of patriotism. "I want you to thoroughly understand," it is reported that Mr. Taylor said to the secretary, "that I am not doing this for the success of any administration nor any official of the administration, but I am doing it for the people of the United States. If this work is to be used for the benefit of any individual I want nothing to do with it."

Meeting on Mercantile Marine

The Academy of Political Science in the City of New York is to devote four sessions of its annual meeting Nov. 12 and 13 to a discussion of the American mercantile marine. Three of the meetings will be held at Columbia University and the fourth will be a dinner meeting at Hotel Astor on Friday, Nov. 12. Among the speakers announced are the following: Hon. John W. Weeks, U. S. Senator from Massachusetts; Hon. Duncan U. Fletcher, U. S. Senator from Florida; Gerard Henderson, Cambridge, Mass.; Prof. G. G. Huebner, University of Pennsylvania; Charles Muchnic, vice-president American Locomotive Sales Corporation; Prof. Henry Raymond Mussey, Columbia University; Welding Ring, chairman Committee on Foreign Commerce and the Revenue Laws, Chamber of Commerce, New York; Prof. William R. Shepherd, Columbia University, and Willard D. Straight, formerly United States Consul-General at Mukden.

Buffalo Machinists Want Eight-Hour Day

The Machinists' Union of Buffalo, N. Y., has made an appeal to all plants in the city employing machinists and kindred workers to grant the men an 8-hr. day with no reduction in pay from that now being received for a 9-hr. day. The Employers' Association, representing practically all of the manufacturing concerns in the city employing machinists, has made a statement through its secretary, John Gorss, that the manufacturers will refuse to receive a delegation representing the union, or in any way to treat with it as a union on the question of adopting an 8-hr. day. From 8000 to 10,000 machinists are now employed in the Buffalo district, and it is claimed that the local union has a membership of less than 700.

The most important development of the labor situation in Cleveland, Ohio, the past week was the action taken by the National Acme Mfg. Company Oct. 25, in asking its employees to sign contracts to work the coming year at the present rate of wages on a 10-hr. basis. The men were given to understand that their services were no longer required unless they signed these contracts. A portion of the men quit. A portion of the Peerless Motor Car Company's men struck to enforce demands for an 8-hr. day with 10-hr. pay. The Wellman-Seaver-Morgan Company has voluntarily reduced its working day from 9 to 8 hr. with no reduction in pay. Machinists employed in the Akron rubber plants and machine shops have been voluntarily given an increase of 15 per cent.

PERSONAL

President Page, New Departure Company

At the annual meeting, Oct. 19, of the board of directors of the New Departure Mfg. Company, Bristol, Conn., De Witt Page was elected president; Frank P. Furlong, Hartford, vice-president; C. T. Treadway, treasurer, and A. C. Hitchcock, secretary. The board of directors consists of those named and Charles F. Pope, H. R. Burwell and Townsend G. Treadway. Mr. Page succeeds Albert F. Rockwell as president, and Mr. Hitch-

DE WITT PAGE

cock succeeds Mr. Page as secretary and sales manager. The new directors are Mr. Hitchcock and Townsend G. Treadway. The new president has been identified with the New Departure Mfg. Company practically since the very first days of its existence. From a minor position in the office of the then New Departure Bell Company, twenty-three years ago, he has won promotion from one position to another in practically all departments. In the earlier days he was paymaster, then purchasing agent, and advertising manager. He was next appointed assistant general manager, and his duties became general throughout the entire factory. About ten years ago he was elected secretary and a director. The business had then grown to such proportions that it was deemed desirable to change the method of marketing the product. Selling through a New York agency was discontinued and a sales force established at Bristol, Mr. Page becoming the head of that department. The change proved thoroughly successful, the company's business since showing a handsome increase each year. In December, 1913, Mr. Page was unanimously elected general manager and will continue in the duties of this office in addition to his work as president. His selection for the head of one of the most important manufacturing concerns in New England shows the confidence of his associates in the abilities, methods and policies which have marked his general management of the company's affairs. He is a native of Meriden, Conn., but spent practically all his boyhood and youth in Hartford, where his two brothers now reside, Bertrand A. Page, first vice-president of the Travelers' Insurance Company, and Ralph E. Page of the Page Hardware Company.

H. M. Ramp, president Elmwood Castings Company, Cincinnati, and C. T. Hughes, superintendent Oakley Colony Power Company, Oakley, Ohio, are consulting engineering associates of E. M. Chace, industrial engineer, who recently opened an office in the Mercantile Library Building, Cincinnati, Ohio.

Judge Elbert H. Gary, chairman of the United States Steel Corporation, received the degree of doctor of laws from Lafayette College, Easton, Pa., Oct. 20. He delivered an address on this occasion on social unrest, in which he discussed the charges of those who believe that there is something wrong in the world, that there is an unequal division of wealth and that the Almighty intended the bounties of the earth to be equally distributed regardless of individual effort or merit. Asserting that such dogmas have received more or less encouragement in a few institutions of learning, and perhaps in some so-called religious bodies in this and other countries, he commended the curriculum of Lafayette College as offering high principles for the direction of young men.

L. Selmi, chief chemist and metallurgist of the Otis Steel Company, has resigned, effective Nov. 1, when he will take charge of the chemical and physical laboratories of the new steel plant of the River Furnace Company (Corrigan, McKinney & Co.), Cleveland, Ohio.

J. F. White, former purchasing agent of the Metal Products Company, Detroit, Mich., has accepted the position of purchasing agent of the Anderson Forge & Machine Company, also of Detroit. The appointment became effective Oct. 15.

Charles W. Baker, recently elected a director of the American Zinc, Lead & Smelting Company, has been placed in charge of the New York office of the company, which has just been opened in the Equitable Building.

Michael W. Donahue, for 27 years connected with the Wire Goods Company, Worcester, Mass., has resigned to accept the position of purchasing agent of the Morgan Spring Company, also of Worcester. He was presented with a mantel clock by the officials and employees of the Wire Goods Company. He will succeed Albert J. Maheu, who has been promoted to a higher position with the Morgan Company.

John F. Childs, for several years a salesman of the Morgan Spring Company, Worcester, Mass., will, Nov. 1, become the New England salesman for the Wright Wire Company, Worcester and Palmer, Mass.

Frank H. Page, Springfield, Mass., has been elected president of the Springfield Board of Trade. He is president of the National Equipment Company and the Van Norman Machine Tool Company, and was a director of the J. Stevens Arms & Tool Company until its acquirement by the New England Westinghouse Company.

Frank W. Skinner, consulting engineer, New York, has returned from a five months' business trip to London, Paris and Havre, where he secured from the Belgian Government orders for several hundred portable interlocking steel houses of his own design, manufactured in the United States, and furnished the British expeditionary force with his slip joint steel piles for protecting military trenches. He was consulting engineer in Paris to the crown prince of Serbia and was technical adviser to Gaston, Williams & Wigmore, New York.

Richard T. Robinson, secretary J. I. Case Threshing Machine Company, Racine, Wis., has resigned and will remove to California. William F. Sawyer, associated with the company for 14 years, succeeds Mr. Robinson. Ellis J. Gittings succeeds Mr. Sawyer as manager of the sales department.

R. H. Stevens, chief mechanical engineer at the Homestead steel works of the Carnegie Steel Company, has resigned to accept a similar position with the Midvale Steel & Ordnance Company, Philadelphia. A. W. Soderberg, assistant mechanical engineer, will succeed Mr. Stevens as chief mechanical engineer.

The offices of H. W. McAteer, comptroller of the Cambria Steel Company, have been removed from Johnstown, Pa., to the executive offices in the Morris Building, Philadelphia.

OBITUARY

CHARLES HUBBARD, senior partner of the firm of Charles Hubbard & Co., 81 Fulton Street, New York, died Oct. 22 at his home in Larchmont, N. Y., aged 81 years. He was at his office on the day preceding his death. Born in Boston, Mass., he was a descendant of the fifth child of John and Priscilla Alden of Plymouth colony. He went to New York in 1856 and entered the employ of the Neptune Iron Works as a draftsman and became a superintendent. Later he was for a long time superintendent for John Roach & Sons, shipbuilders. He started in business for himself in 1870, representing various iron and steel interests. For many years he was agent for the old Nashua Iron & Steel Company, Nashua, N. H., one of the first makers in this country of open-hearth steel plates. Mr. Hubbard is claimed to have been the first to introduce 72-hr. foundry coke in the New York market, as selling agent for the H. C. Frick Coke Company. In conjunction with Samuel Osborn of Sheffield, England, he introduced Mushet's tool steel. About 1866 he designed a double-ended ferry boat, but the shipbuilders of New York did not approve the idea, declaring it not practical. His wife died in 1906. He leaves a son, Charles D. Hubbard, Wyncote, Pa., and a daughter. The business is continued under the old name by Lyman J. Fisher.

BAXTER DODDRIDGE WHITNEY, probably the oldest manufacturer of wood-working machinery in the United States, died Oct. 17 at his home in Winchendon, Mass., aged 98 years. He was the founder of the firm of Baxter D. Whitney & Son, in which he was active until 1900, when he turned the management over to his son, William M. Whitney. He was born in Winchendon. He early displayed mechanical ability, and on leaving school entered the repair room of his father's woolen mill. At the age of 20 he had built several steam jigs and sixteen looms for weaving cashmere. In 1849 he founded the present business and built the first power machinery used in the manufacture of wooden tubs and pails. He designed the first practical cylinder planer and later developed the present line of wood-working machinery. He was a member of the American Society of Mechanical Engineers.

GEORGE R. MENEELY, Albany, N. Y., died Oct. 23, aged 84 years. He was for 25 years in partnership with his brother Edwin in the manufacture of bells at West Troy. In 1876 he began at another location in West Troy (now Watervliet) the manufacture of railroad supplies. This business, under the name of George R. Meneely & Son, Inc., is still carried on in Watervliet, where Mr. Meneely was actively engaged in manufacturing for 64 years. He leaves his widow, a daughter and a son, Charles D. Meneely, vice-president Brooklyn Rapid Transit Company, Brooklyn, N. Y.

THOMAS EDWARD VICKERS, a pioneer in the armament industry, died in London, Oct. 19, aged 83 years. He was interested in, but not recently active in the management of, the great establishment known as Vickers, Ltd., having its headquarters at Sheffield, with branch works at various places in England, Italy, Russia, Spain, Brazil and Japan, and an interest in shipbuilding works at Montreal, Canada.

MICHAEL T. HORNER, president Jones Hollow Ware Company, Baltimore, Md., died Oct. 19, aged 61 years. He was born in Baltimore in 1854, was graduated from the Chester Military School, Chester, Pa., was one of the organizers of the Jones Hollow Ware Company, and became president in 1889. He leaves his widow, three sons and two daughters.

AUGUSTUS J. DUBOIS, for 30 years professor of civil engineering in the Sheffield Scientific School, died suddenly Oct. 19, at his home in New Haven, Conn., aged 66 years. He was a native of Newton Falls, Mass. He became widely known as an author on engineering subjects, paying particular attention to the matter of stresses in framed structures. He leaves his widow.

JACOB B. FRICKER, Reading, Pa., died Oct. 18, aged 76 years. He was president of the Reading Hardware Company and Crescent Brass Mfg. Company, and was interested in a number of other manufacturing enterprises. He was also a builder and had erected more than 1000 dwellings and other structures in Reading.

GEORGE F. FENNER, president Babcock Printing Press Company, New London, Conn., was instantly killed Oct. 21, when the automobile in which he was riding was struck by another car near New London.

Pittsburgh and Nearby Districts

The Pennsylvania Public Service Commission will resume consideration at Pittsburgh, Nov. 9, of the slag rate case, involving charges for hauling slag from furnaces and mills. Most of the large steel companies of the western part of the State have intervened in the case.

The Interstate Commerce Commission was in session in Pittsburgh nearly all of last week, and is continuing its hearing this week, taking the testimony of steel manufacturers in regard to rates on Lake Superior ore to points in western Pennsylvania, West Virginia and eastern Ohio. The commission is investigating primarily the 88c. freight rate on Lake Superior ore from lower Lake ports to Pittsburgh and Wheeling, to determine, if possible whether this rate is an injustice to Wheeling steel makers, who contend that, as the distance from lower Lake points to Wheeling is much less than to Pittsburgh points, Wheeling should have a lower rate.

The report that the Andrews & Hitchcock Iron Company, Youngstown, Ohio, is building a slag crusher at its furnace plant is incorrect. The crusher is being built by the Standard Slag Company, Toledo, Ohio.

The Pittsburgh Steel Company, Pittsburgh, has issued a statement of sales and earnings for the three months ended Sept. 30, 1915, compared with the corresponding period of 1914, as follows:

	1915	1914	Increase
Sales	$4,431,777.66	$2,269,994.35	$2,161,783.31
Net profits	673,352.32	106,919.88	566,432.44

Under date of Oct. 20, the Vanadium Alloys Steel Company, Pittsburgh, issued new and higher prices on high grade tool steels, making Red Cut Cobalt, $2.20 per lb. base; Red Cut Superior, $2.10; Vasco Marvel, $1.60. These prices include the standard extra of 2c. per lb. for annealing.

The Brier Hill Steel Company, Youngstown, Ohio, has under consideration the matter of building seventy-five or more by-product coke ovens to supply coke for its Grace and Tod furnaces.

No. 1 blast furnace of the Republic Iron & Steel Company at Haselton, Ohio, which was blown out recently for repairs to the bosh, will resume blast again this week.

The blast furnace of the Struthers Furnace Company at Struthers, Ohio, is making some new records for output. On Oct. 11 it made 581 tons of basic iron, beating its best previous record of 548 tons made Oct. 4. The average per day of the stack for the month up to Oct. 16 was 508 tons. Not an off cast of basic iron has been made in the furnace since July 14 last.

The Pittsburgh offices of the Dayton Pipe Coupling Company, Dayton, Ohio, and the Van Dorn Iron Works Company, Cleveland, Ohio, have been removed from rooms 2348-49 to rooms 904-5 Oliver Building.

The William Tod Company, Lloyd Booth department of the United Engineering & Foundry Company, Trussed Concrete Steel Company, General Fireproofing Company and a number of smaller concerns at Youngstown, Ohio, employing machinists, have agreed to advance wages about 15 per cent, on condition that there would be no demand made by the men for an 8-hr. day. The men accepted the advance with this understanding.

Machinery Markets and News of the Works

STRIKES HALT DELIVERIES

Recognition of Union Worst of Problem

War Contractors Heavy Buyers and Domestic Business Improving in All Sections—West Hampered by Small Stocks

Builders of machine tools and their representatives are proceeding slowly in the matter of booking further orders for delivery far ahead, as might be expected in view of the strikes which have delayed shipments and will necessitate many readjustments. The strike situation in Cincinnati is believed to be clearing up inasmuch as many of the men are drifting back to the shops, and it is probable that some of the trouble will be over by the end of the month. No attempts were made last week to start idle plants in Hamilton, Ohio. About 150 machinists employed by the Detrick & Harvey Machine Company, Baltimore, have gone on strike. The entire trouble might soon be adjusted were it not for the demand that the union be recognized. Insistence on this point is quite as much at issue as any question of hours or wages.

In the New York market the demand from the larger war contractors continues heavy, while there is a good demand from the industrial field also. Buying for export, particularly to Russia, is active. Through J. P. Morgan & Co., the American Steel Foundries has received a large order for shell forgings. The Westinghouse Electric & Mfg. Company will machine the forgings. The Automatic Transportation Company, Buffalo, N. Y., will build an addition to its plant to provide space for filling munitions orders.

The demand for both new and second-hand machines is brisk in Detroit. The manufacturers of that city are finding some difficulty in getting raw steel and deliveries have been delayed from that cause. The Chalmers Motor Car Company, Detroit, has let a contract for an additional building, 60 x 200 ft.

Inquiries have fallen off a little in Cleveland, although the volume of business is still good, with a notable betterment in domestic business. An inquiry for 100 lathes for machining shrapnel is again before the Cleveland market. The activity at the steel mills has made a great deal of business for the builders of cranes.

The Wood Turret Machine Company, Brazil, Ind., has plans for a duplicate plant which will be devoted to the manufacture of 6-in. lathes. The Haynes Automobile Company, Kokomo, Ind., is arranging for an additional plant to cost $250,000.

The demand for machine tools is unabated in Milwaukee, and the increase of production does not seem to have eased the situation. The Bucyrus Company, South Milwaukee, has taken an order for 8-in. shells; also an order for forgings which will require the erection of a new building containing presses and furnaces.

Wood-working machinery is in good demand in the Central South, also in the Birmingham district. St. Louis notes a keen demand for second-hand tools, of which there are few to be found. In Texas some orders were taken last week for machinery and tools for shipment to Mexico. General trade conditions in the Southwest are good.

San Francisco is encouraged over the better outlook in Mexico. In that city small orders for machine tools are fairly numerous, but business continues to be restricted by the lack of stock. Conditions are improving in the Pacific Northwest. A peculiar feature reported is that a Seattle company making cannery machinery has shipped lathes to eastern munitions plants.

New York

NEW YORK, Oct. 26, 1915.

War contractors continue their quest for machine tools and are placing orders in large volume, while the demand from miscellaneous directions is bringing the daily sales of dealers up to an extremely satisfactory figure. Deliveries are the sore point, and for this condition the strikes in various parts of the country are largely to blame. Were it not for the labor trouble one large firm could increase its deliveries by a third. Just how some of the machine tool builders are going to solve their problems is at present a matter of guesswork. The situation at plants where production is cut down by strikes is rendered most serious by the fact that any prolonged deadlock may lead to the men drifting away, either of their own volition or through the enticement of employment agents. As stated heretofore, it has been difficult to hold employees, or to get them, because of the high wages and inducements held out in many fields. If the troubles were merely a matter of wage adjustments settlements would be comparatively easy, but added to this phase of the question must be added to the efforts of labor leaders to unionize shops which have long happily existed as open-shop organizations. Once the organizer gets a foothold and a strike is declared fear impels many of the men to stay away from their work.

The demand for cartridge metal has given a great stimulus to the manufacture of brass mill machinery, practically all of the sheet brass makers having increased their equipment, while some new mills are being installed. The Birmingham Iron Foundry, Derby, Conn., has received an order for a brass rolling mill for the Western Cartridge Company, Alton, Ill. J. B. Wise, Watertown, N. Y., who received a large order for cartridges through J. P. Morgan & Co., has purchased four sets of rolls from the Birmingham Iron Foundry. The buyers will be independent of New England brass makers.

Through various representatives Russia is actively seeking machine tools in this country. P. M. Neuschul, of Mett & Co., Petrograd, Russia, who bought here extensively some months ago, is again here and inquiring for tools. He is at the Hotel Vanderbilt. Other inquiries have been issued by Austin Baldwin & Co., freight contractors, 42 Whitehall Street, New York; Gaston, Williams & Wigmore, 140 Broadway, New York, and by a commission representing the Roumanian Government. Shell-making machinery predominates in all the inquiries. Lee Higginson & Co., bankers, 43 Exchange Place, New York, are reported to be interested in buying.

It was stated in THE IRON AGE last week that certain department heads of the Remington Arms & Ammunition Company were believed to be connected with the New Haven Equipment Company, a new organization formed to take war orders. It is denied that any of the present Remington department heads are connected with the new company, but it is said that those interested are former department officials of another New England arms company.

Collections are satisfactory. The second-hand machinery market continues active, the only difficulty being in finding machines to sell.

Through J. P. Morgan & Co., the American Steel Foundries has secured a contract for supplying war materials valued at $20,000,000. The company is to supply forgings for shells of various sizes, which will be machined by the Westinghouse Electric & Mfg. Company. The latter company will receive about $11,000,000 for the work, thus bringing the total of its war orders to about $90,000,000.

The E. W. Bliss Company, Brooklyn, N. Y., has filed plans for a three-story concrete and steel building, to cost $175,000. The building will occupy a site 200 x 320 ft. at Fifty-third Street and First Avenue. The new building is necessitated by the volume of war contracts which the company has on hand.

The Efficiency Machine Company, 136 Liberty Street, New York, plans to build automatic machinery and do jobbing and manufacturing machine shop work. It is in the market for a two-story brick factory near New York with about 50 ft. frontage and light on all sides. An equipped machine shop is preferred. In case the company does not find such a shop, it will be in the market for milling machines, shaping machines, lathes, drill presses, plunge presses and a general line of small tools. C. H. M'Giehan is president.

The Mica Insulator Company, Schenectady, N. Y., will build an addition to its factory on Villa Road.

The Lucas-Tuttle Mfg. Company, Silver Springs, N. Y., has filed incorporation papers with a capital stock of $25,000 and will manufacture wooden boxes, novelties, etc. P. C. Lucas, Silver Springs; E. K. Lucas, Gainesville, and T. E. Tuttle, Seneca Falls, are the incorporators.

The Modern Machine & Tool Company, Albany, of which Charles Simmons is general manager, has plans in progress for a one-story addition, 125 x 200 ft., to its factory.

The Victor Aluminum Mfg. Company, Wellsville, N. Y., has been incorporated with a capital stock of $150,000 to manufacture aluminum and other metallic compounds. F. L. Rockwell and W. E. Browning, Wellsville, and J. L. Rockwell, Hornell, are the incorporators.

The Plastergon Wall Board Company, Tonawanda, N. Y., will move its business to Buffalo, where it is erecting a new plant between Philadelphia and Evelyn streets on the New York Central Railroad.

The Ramapo Mountains Water Power & Service Company, Ramapo, N. Y., has been incorporated with a capital stock of $150,000, and will construct a water-distributing plant. J. B. and D. S. Rider, South Norwalk, Conn., and W. H. Fritchman, Brooklyn, N. Y., are the incorporators.

A. A. Valrath & Son, Fort Plain, N. Y., are taking bids for a factory 50 x 185 ft., which they will construct this fall.

Articles of incorporation have been filed by the Trotter Mfg. Company, Rochester, N. Y., with a capitalization of $30,000 to manufacture machines, fixtures and appliances for the production of light, heat and refrigeration, refrigeration plants, etc. H. L., F. C. and C. E. Trotter are the incorporators.

The Universal Brush Company, Troy, N. Y., has completed plans for the erection of a brush factory, 50 x 86 ft., at Ninth Avenue and Second Street.

The Automatic Transportation Company, Buffalo, will build an addition to its plant at Main Street and the Erie Railroad, to afford extra facilities required for filling munition orders which it has received. A large amount of special machinery will be installed. William C. Carr is president.

The Hall-Rodler Machine Company, Buffalo, has been incorporated to manufacture special machinery. Carl A. Bauman, Joseph L. Mesner and Ray C. Hill, 266 Lexington Avenue, are the incorporators.

The Titanium Alloys Mfg. Company, Niagara Falls, N. Y., has let contracts for a brick and steel addition to its foundry and for a storage building.

The Rochester Stamping Company, Rochester, N. Y., has let contract for erection of factory, 60 x 151 ft., on Anderson Avenue.

The Alexander Shumway & Utz Company, Rochester, N. Y., has been awarded general contract for the construction of additional buildings for the Eastman Kodak Company at Kodak Park, 83 x 165 ft., five stories, and 43 x 140 ft., two stories, of reinforced concrete, brick and steel.

The Franklin Mfg. Company, manufacturer of automobiles, Syracuse, N. Y., has let contract for erection of a six-story factory, 107 x 265 ft., of brick and steel, to cost $175,000.

Philadelphia

PHILADELPHIA, PA., Oct. 25, 1915.

The Felton-Sibley Company, 136 North Fourth Street, Philadelphia, paint manufacturer, will erect a new plant at Fourth and Cherry streets at a cost of about $15,000. It will be six stories, of reinforced concrete.

The Speer Carbon Company, St. Mary's, Pa., is rushed with orders to such an extent that it is making plans for doubling the capacity of its plant. The output at present is 10,000 carbons daily for moving picture machines. J. S. Speer is president.

The contract for a boilerhouse for the Ripka Mills Company, Manayunk, Pa., has been awarded to Elmer L. Cuthbertson. It will be one story, 70 x 98 ft. Peuckert & Wunder, Philadelphia, are the architects.

William Keas, 4624 Penn Street, Philadelphia, has been awarded contract for the erection of a one-story brick machine shop, 44 x 144 ft., to be erected at Tucker and James streets, for Fayette R. Plumb, Inc., at a cost of about $6,000.

A fire occurred at the plant of the American Asbestos & Covering Company, Seven Stars, near Conshohocken, Pa., Oct. 23, causing about $5,000 damage to the roof and upper floor.

A fan and boilerhouse of the Susquehanna Coal Company, Shamokin, Pa., was blown to pieces Oct. 24 by a boiler bursting. The loss to the property is $2,500.

The Sullivan Needle Company, Reading, Pa., with a capital stock of $5,000, has been incorporated by John E. Sullivan, 619 North Fifth Street, Reading; William B. Sullivan, Pittsburgh; Walter J. and Charles Bagshaw, Lowell, Mass., to manufacture talking machine needles, etc.

A permit has been granted to Robert Beatty & Bro., 2331 East Fletcher Street, Philadelphia, for the construction of a one-story brick powerhouse, 18 x 32 ft., to be erected for the Thomas Henry & Sons Company, Tioga Street and Trenton Avenue, Philadelphia, at a cost of about $1,500.

The Ridgway Electric Light Company, Ridgway, Pa., plans to issue $150,000 capital stock to pay for extensions and plant improvements.

The Fulton-Walker Company, Twentieth and Filbert streets, Philadelphia, has been incorporated with a capital of $15,000 by J. N. Chamberlin, Ninth and Chestnut streets, Philadelphia; Edmund S. Mills, Fort Washington, Pa.; Russell Shepherd, 913 South Fifty-ninth Street, Philadelphia, to manufacture wagons, automobiles, trucks, etc.

Baltimore

BALTIMORE, MD., Oct. 25, 1915.

All-steel cars are to be made at the Baltimore Car & Foundry Company, Curtis Bay, Md. Howard R. Carlton is the Baltimore representative. The plant will be one of the largest in the South. About ten acres adjoining the present plant have been purchased. The addition will be 273 x 1200 ft., and will cost about $500,000. The work has been started and will probably be completed early next year.

The Harvey Company, 113 South Street, Baltimore, is in the market for a standard gage saddle tank locomotive, nearby delivery, equipped with air-brake, 75,000 to 100,000 lb.

The United Machinery Company, Baltimore, has been incorporated with $200,000 capital stock, to deal in machinery. The incorporators are Hugh Lenox Bond, 1205 Continental Building, Baltimore, H. Webster Smith and H. Ralph Cover.

The John B. Adt Company, 324-344 North Holliday Street, Baltimore, has engaged in the manufacture of cereal-preparing machinery.

Demanding an 8-hr. day, about 120 machinists employed at the plant of the Detrick & Harvey Machine Company, Baltimore, Md., which was recently taken over by the Bethlehem Steel Company, have gone on strike.

The plant of the Diamond State Steel Company, South Wilmington, Del., is being put into shape for operation. Howard T. Wallace, former president of the company, stated that it will be put into operation as soon as possible, but no definite time has been set. It has been idle about eleven years.

Plans are being made to place the plant of the Remington Arms Company, Eddystone, Pa., in full operation. Machinery is being hurriedly installed and many workers are being called.

For the use of the International Automobile Company, J. T. Whitehurst, 401 East Oliver Street, Baltimore, will erect a one-story service station, 66 x 150 ft., at 1006 North Eutaw Street.

New England

BOSTON, MASS., Oct. 25, 1915.

The contract for the additions to the plant of the Bristol Brass Company, Bristol, Conn., has been let to Levering & Garrigues, New York City. It calls for the completion of the rolling mill and casting shop by Jan. 20.

It is reported that the Hendee Mfg. Company, Springfield, Mass., will soon begin to manufacture aeroplane engines for the new company, which has taken over the Wright Company, Dayton, Ohio. The fact that two of the directors of the Hendee Company are directors of the new company lends credence to the report.

It is expected that the Waterbury Tool Company will give up its quarters in the building of the New Britain Machine Company, New Britain, Conn., when its new plant in Waterbury is ready for occupancy.

The Bath Iron Works, Bath, Me., has been awarded a contract by the navy department to build a destroyer at a cost of $879,500.

The Lake Torpedo Boat Company, Bridgeport, Conn., will build three submarines for the United States Government at a cost of $545,000 each. These will be built in the company's new yard and will provide employment for several hundred more men. The company is now building four submarines for the Navy Department in its old yard. The Lake Company has just bought thirty parcels of land adjacent to the twenty-six lots purchased last spring, which will make the new shipyard sufficiently large so that the largest type of vessels can be laid down. The angle and plate shop is already under cover, and other buildings will be ready in time to house the other departments of the new yard. In the old yard the office, engineering and drafting departments are occupying their new quarters, which are four times as large as the old building. Orders have been issued for the construction in the old yard of a machine shop and electrical building. The company has its own construction crew.

The Fafnir Bearing Company, New Britain, Conn., has filed a certificate showing an increase of capital stock from $200,000 to $500,000.

It is reported that Cheney Brothers, Manchester, Conn., contemplate the erection of a power plant on the south side of Hartford Road. It is now buying electric power from Hartford.

The Noble & Westbrook Mfg. Company is building a brick factory building, 22 x 30 ft., two stories, on Westbrook Street, East Hartford, Conn.

A company has been organized at Portland, Me., to build a cold storage plant for fish-freezing purposes. The authorized capital is $100,000, and the plant is to be located at the end of Union Wharf, Portland.

Clayton Brothers, Inc., Bristol, Conn., has leased the factory buildings recently vacated by the L. H. Snyder Company.

The Benedict & Burnham branch of the American Brass Company, Washington Avenue, Waterbury, Conn., has awarded a contract for a factory, 80 x 160 ft., one story.

The W. & B. Douglas Company, Middletown, Conn., is reported to be rushed with orders. It is turning out a number of heavy lathes. Alterations are being made to provide for the installation of two five-ton travelling cranes.

The Northern Brass Company, Whitinsville, Mass., recently incorporated with capital of $15,000, will build a one-story foundry and a two-story machine shop.

The Randolph-Clowes Company, Waterbury, Conn., has secured a building permit for a one-story addition.

Indianapolis

INDIANAPOLIS, IND., Oct. 25, 1915.

Plans for the building of an addition to the plant of the Wood Turret Machine Company, Brazil, Ind., have been prepared. The machine shops have been working night and day for several months. The new building will be practically a reproduction of the present plant, doubling the capacity. It will be used to manufacture 6-in. turret lathes. At the present plant 3-in. machines are manufactured. D. W. Wood is president.

The Haynes Automobile Company, Kokomo, Ind., is arranging for the erection of an additional plant to cost about $250,000.

The Oxygenated Stove Company, South Bend, Ind., has been incorporated with $50,000 capital stock to manufacture stoves. The directors are Albert W. Craig, John E. Searles and Floyd A. Deahl.

The Hert Mfg. Company, Indianapolis, has increased its capital stock $85,000, making the total capitalization $100,000.

The Hay Wrench Mfg. Company, Indianapolis, has been incorporated with $85,000 capital stock to manufacture a combination pipe and nut wrench. The directors are Franklin S. Hay, Merle M. Ladwig and Martha Hay.

The American Locomotive Superheater Company, East Chicago, Ind., has broken ground for another plant, which will double its capacity.

The Jasper Mfg. Company, Jasper, Ind., manufacturer of furniture, has let the contract for factory buildings. The main building, which will be the machine and cabinet room, will be 60 x 232 ft. An ell will connect with the main building, 60 x 400 ft. The glue room with be 31 x 60 ft.; the boiler and engine room, 33 x 40 ft. The buildings will all be one story, of brick construction.

The American Goggle Company, Whiting, Ind., has been incorporated with $50,000 capital stock to manufacture goggles and eye shields. The directors are Roy E. Green, Charles E. Klose, William Zimmerman.

The American Steel Products Company, Indianapolis, Ind., has been incorporated with a capital of $25,000, to manufacture devices for automobiles, trucks, motor boats and aeroplanes, by Louis H. Oberreich, H. E. Oberreich and Joseph R. Martz.

The Hercules Gas Engine Company, Evansville, Ind., will build a brick addition to its factory, 100 x 150 ft.

Chicago

CHICAGO, ILL., Oct. 25, 1915.

The Illinois Central Railroad has completed the buying of machine tools on its inquiry which has been in the market for a number of weeks. The final purchases were somewhat reduced in number from the original inquiry, largely because of the impossibility of securing early delivery of new machines as well as the high prices now obtaining. Other railroad buying which has been expected is still pending. The demand for machine tools for industrial purposes has slackened somewhat, and this condition is rather welcome than otherwise.

The Maher & Byrne Company, Chicago, has changed its corporate name to Anson-Byrne Company and will continue, as formerly, to act as Chicago representatives for the Palm Vacuum Cleaner Company, stationary vacuum cleaners; the Blaisdell Machinery Company, air compressors and vacuum pumps and the Kingsford Foundry & Machine Works, centrifugal pumping machinery.

The Illinois Machinery Company, Chicago, has been organized by Egbert Robertson, 38 South Dearborn Street, Lazarus Krinsky and John L. Anderson, with a capital stock of $5,000.

The Lacy Machine Company, Chicago, has been incorporated with a capital stock of $10,000 by Franklin H. Lacy, Frank W. Kee and Paul Corkell, 105 West Monroe Street.

Neiler, Rich & Co., have completed plans for a one-story power plant for the Chicago & Northwestern Railway Company, to be erected at Park and Lawrence avenues, Chicago.

The American Bridge Company, Chicago, will build a one-story brick forge shop, 62 x 96 ft., at 4000 Princeton Avenue, to cost $9,000.

The National Typewriter Mfg. Company, Chicago, has been incorporated with a capital of $50,000 by Paul H. Cooper, Jr., Aurora, Ill., P. H. Cooper and H. J. Cooper.

Postle & Fisher have completed plans for a one-story brick factory, 209 x 480 ft., for the Western Shade Cloth Company, to be erected at 2000-44 South Jefferson Street, Chicago, at a cost of about $75,000.

The Havana Metal Wheel Company, Springfield, Ill., is building a factory of reinforced concrete, to cost $25,000.

The Western Mfg. Company, Peoria, Ill., has been incorporated with a capital stock of $12,500 by O. S. Rippeth, A. E. Wolf and George W. Burton to manufacture aluminum, brass, copper and tin utensils.

The Western Cartridge Company, East Alton, Ill., which has been planning a new plant, has determined to enlarge its present plant and also to locate the new plant at Springfield, Ill., where 600 acres have been acquired for high power explosive manufacture. The new plant will be equipped at once.

The Aluminum Ore Company, East St. Louis, Ill., has begun the equipment of an additional plant to cost with machinery, etc., $1,000,000, for the recovery of aluminum from clay deposits.

The American Improved Seat Company, 916 New York Life Building, Minneapolis, Minn., incorporated with a capital stock of $250,000, has purchased 3½ acres at Hopkins, Minn., on which it will erect a factory for the manufacture of seats for railway cars, automobiles, theaters, etc. C. A. Webber

is president, E. W. Schlappritzi, vice-president, and G. E. Bauers, secretary.

G. O. House, general superintendent of waterworks, St. Paul, Minn., will have plans ready Nov. 1 for a 15,000,000-gal. pumping engine.

The Safety Appliance Mfg. Company, Duluth, Minn., has been organized with a capital stock of $50,000 by Joseph M. Averbook, Bertel B. Brosvick and B. M. Schneider.

Joseph B. Merwin, Omaha, and Peter J. Witt, Paynesville, Minn., are considering erecting a factory at St. Paul for the manufacture of an automatic semaphore.

The Dauch Mfg. Company, Sandusky, Ohio, will build a factory at Wichita, Kan., for the manufacture of machinery.

The New Monarch Machine & Stamping Company, Des Moines, Iowa, is building a factory, 115 x 200 ft., to cost $200,000.

Bids will be received until Nov. 5 for a waterworks system for Bayard, Neb., to include a triplex pump of 350-gal. per minute capacity and a 30-hp. oil engine. Selzer & Finley, Scottsville, Neb., are the engineers.

Milwaukee

MILWAUKEE, WIS., Oct. 25, 1915.

Demand for machine tools continues unabated. The increased production does not seem to have the desired effect of easing the situation, although deliveries have been hastened thereby. Refrigerating machinery is in good demand. Foundries are increasing pay-rolls, and the limit of available skilled help in this division will probably be reached soon. Agricultural implement manufacturers, particularly those employing gasoline engines, are experiencing a heavy demand, undoubtedly due to the bumper grain crop. The organization of many new companies in the metalworking trade indicates a revival of new business and freer capital.

The Wehr Steel Company, Forty-fifth Avenue and Gordon Street, West Allis, Milwaukee, will add 75 men to its payroll when the addition to its foundry is completed. The present pay-roll numbers 125.

The Bucyrus Company, South Milwaukee, Wis., says that recently published statements regarding a merger of the company with other interests are entirely without foundation. Within the last two months the company has taken orders for excavating machinery for several foreign countries as well as domestic orders. These machines are largely the development of recent years for special purposes, including coal-stripping, levee building and tin mining. There has been practically no improvement in the business in old established lines, such as railroad equipment and general contractors' shovels. The company has also taken an order for 8-in. shells, which will not be machined at South Milwaukee. It has further taken an order for forgings, which will utilize its furnace capacity not now used for its regular work and will require the erection of a new building for the installation of the necessary presses and furnaces. Certain miscellaneous machinery orders have also been booked, such as revetment machines, for work on the Mississippi River, and hydraulic presses.

The George H. Smith Steel Casting Company, 500 Clinton Street, Milwaukee, closed bids Oct. 23 for the erection of its new shipping room. The building will be of solid brick and steel, one-story, 65 x 160 ft. The work is in charge of Klug & Smith, consulting engineers, Milwaukee.

The Kellar Pneumatic Tool Company, South Brooke Street, Fond du Lac, Wis., has put on a night shift to enable it to meet the demand for special tools, dies, punches, etc., principally from automobile makers. The company states that it has enough orders from one automobile manufacturer alone to insure 24-hr. operations until Jan. 1. Julius Kellar, Jr., general manager, said that during the last four or five months it has turned down orders for war materials, preferring to confine its activities to the old established lines of products.

Plans for the new plant of the Hartford Tire Pump Company, Hartford, Wis., have been revised so that it will be two stories with part basement. The owner is L. J. Knickerbocker and the work is in charge of architects Val. A. Siebert & Co., Milwaukee.

Oshkosh, Wis., has engaged H. A. Allen, consulting engineer, Chicago, to prepare plans and specifications for a filtration plant in connection with the municipal waterworks system. The filtration system will have a daily capacity of 6,000,000 gal., and work will begin early next year.

Work is progressing rapidly on the new plant of the Graf Stove & Range Company, Silverlake, Wis. The company was organized during the summer by H. J. and Theodore H. Graf, Louisville, Ky., who have been engaged in stove and range manufacture for many years. The capital stock is $100,000 and local capital has taken a heavy interest. The plant consists of three buildings, two being 80 x 166 ft. and 35 ft. high, with saw-tooth roofs, and a pattern vault and office, 35 x 45 ft. One building will be used for molding and assembling and the other for casting, finishing and warehouse. The North-Western line runs along the east side of the plant and the Soo line across the north end, affording excellent shipping facilities. The equipment of the former plant in Louisville is being installed, and orders have been placed for all the new equipment required.

The National Brake & Electric Company, Milwaukee, has increased its payroll during the last sixty days from 700 to 1100 workmen. It is stated that the plant is developing a new type of motor truck designed especially for war use, but details are not available.

Detroit

DETROIT, MICH., Oct. 25, 1915.

The demand for both new and second-hand machine tools continues brisk, and the month is showing a fine record for sales. Inquiries are numerous and cover the requirements for many different lines of manufacture. The industrial situation is good, and many plants are working overtime. It is reported in some quarters that metal manufacturers are experiencing difficulties in securing prompt delivery of raw steel and are in consequence handicapped in trying to keep up with orders. The recent labor troubles seem to have been adjusted and no sign is apparent of further disturbances. Construction work is increasing and is about normal for this time of year.

Contracts have been let by the Chalmers Motor Company, Detroit, for the construction of an addition to its plant, 60 x 200 ft., four stories. The building will contain an extension of the machine shop and stock room and will allow for an increase in the company's output.

The Disco Starter Company, Detroit, manufacturer of automobile starters, has increased its capital stock from $60,000 to $100,000 to provide for increasing business. It is stated that this is preliminary to a larger increase to enable the company to extend its factory accommodations.

The Auto Wheel Company, Lansing, Mich., has begun the erection of a one-story addition, 54 x 160 ft., to house its hub department. The building with its equipment will represent an investment of $20,000.

The shops of the MacKinnon Boiler Company, Bay City, Mich., recently destroyed by fire with a loss of $50,000, will be rebuilt on a larger scale.

The Blackmer Rotary Pump Company, Petoskey, Mich., will erect a one-story addition, 42 x 78 ft.

The Kalamazoo Stationery Company, Kalamazoo, Mich., paper manufacturer, will increase its capital stock from $100,000 to $250,000.

The Nelson-Blanck Mfg. Company, Detroit, Mich., is erecting an addition to its plant for the manufacture of spindle drill heads.

The Fox Machine Company, Grand Rapids, Mich., will erect a factory at Jackson, Mich.

The Howell Electric Motors Company, a new incorporation with a capital of $30,000, will erect a factory at Howell, Mich.

Cleveland

CLEVELAND, OHIO, Oct. 5, 1915.

The volume of business is still good, but new inquiries are falling off somewhat. While few Cleveland plants are at present affected by strikes, the uncertainty of the situation is causing considerable uneasiness and influencing orders. Inquiry for equipment for machining shells is not so active. This is due to some extent to the fact that Cleveland companies that were figuring on shell work are now well filled up in their regular lines and do not care particularly to take orders for munitions. One local inquiry, however, for 100 lathes for machining shrapnel shells, which came out a few weeks ago, has been revived. Builders of cranes and various other machinery equipment are busy. The volume of orders has improved recently, owing to the demand from steel plants.

The Cleveland Electro Metals Company, West Twenty-fifth Street, Cleveland, is having plans prepared for a plant which will include a two-story factory, 54 x 100 ft., and a one-story foundry, 50 x 60 ft.

The Premier Brass & Forgings Company, Cleveland, has established a plant in the buildings formerly occupied by the Avery Stamping Company, 5207 Lakeside Avenue, and will manufacture small forgings. H. Moschell is manager.

The Defiance Screw Machine Products Company, Defiance, Ohio, will enlarge its plant by the erection of a brick and steel building, 50 x 125 ft.

The Doehler Die Castings Company, Toledo, Ohio, has purchased a site on Smead Avenue on which it will erect a factory. The space provides for 200,000 sq. ft. of floor space, of which about 60,000 sq. ft. will be utilized for the first building. The company has outgrown its present quarters in the Toledo Factories Building.

The Standard Electric Stove Company, Toledo, Ohio, has increased its capital stock from $100,000 to $300,000, a portion to be used for the purchase of additional equipment.

A new plant will be established in Canton, Ohio, for the manufacture of mechanical toys and automobile specialties. Frederick G. Grant, Cleveland, representing the Universal Mfg. Company, has secured an option on the plant of the Great National Products Company which will be used as a site. The organization of the company is indirectly a result of the war, which has cut off the shipments of toys from Europe.

The Wapakoneta Machine Company, Wapakoneta, Ohio, will enlarge its plant by the erection of a building, 50 x 50 ft.

The Efficiency Heater Company, Piqua, Ohio, has been incorporated with a capital stock of $150,000 to manufacture warm air furnaces and accessories. The incorporaters are H. D. O'Neill, Eugene Johnson, H. L. Richards, W. S. Burton and J. L. Murray.

The Perry-Fay Company, Elyria, Ohio, is building an extension to its plant providing about 4000 sq. ft. of additional floor space. The company is busy on automobile work, the volume of which necessitates the increase in capacity.

Cincinnati

CINCINNATI, OHIO, Oct. 25, 1915.

Although demands by labor leaders have been made on two additional local plants, one of these is operating with 75 per cent of a normal force, while no definite action has been taken at the other plant. It is generally thought by the management of the last named shop that should a strike be called, only a small number of their employees will quit work. Workmen are drifting back to the plants that were previously affected, and it is the general opinion that the present trouble will be over before the end of the month, or within ten days at the outside.

The situation at Hamilton, Ohio, is unchanged. No new shops have gone out, and no attempts were made last week to start up the idle plants. In Dayton, Ohio, one large manufacturer making war munitions has had trouble, and is operating with a reduced force. The daily press has somewhat confused the public in stating that the eight-hour day was the only question at issue, and that no demands have been made for recognition of the union. Rule No. 3 of the official demands shows this to be erroneous, although the skillful wording of the paragraph would mislead a casual reader.

Inquiries for different kinds of machine tools, from both domestic and foreign sources, continue to be received, but both sellers and buyers are slow about making contracts for deliveries far ahead. Portable electric tools are moving satisfactorily. The jobbing foundries are busy and the boiler and tank business is improving.

The Joseph Joseph & Brothers Company, Cincinnati, has removed its offices temporarily to the First National Bank Building. It is erecting a new office building at its plant on Harrison Avenue that will provide 6000 sq. ft. additional space when completed. Electric elevators will also be installed.

The Pollak Steel Company, Carthage, Cincinnati, has had plans prepared for additions to its forging department, 125 x 128 ft., and 30 x 60 ft., one story, of steel construction. All necessary equipment is reported to have been provided for.

The Cincinnati Bickford Tool Company, Oakley, Cincinnati, has tentative plans under way for a two-story reinforced concrete fireproof building to be used as a pattern shop and for storage purposes.

The Tubular Steel Products Company, which intends to build a steel mill at Reading, Ohio, a Cincinnati suburb, has opened offices in suite 1616, First National Bank Building, Cincinnati. Plans for the proposed plant will be completed soon.

The Advance Battery & Mfg. Company, Cincinnati, has been incorporated with $10,000 capital stock and will probably locate at 515 Race Street. No mechanical equipment will be needed just now, but later the company expects to manufacture a number of metal specialties. The incorporators are C. G. McCrea, G. L. Buhrman, C. E. Ogden, A. Brandes and F. W. Farnsworth.

The Flexible Wooden Shoe Sole Company, Cincinnati, will equip a building at Liberty and Moore streets, for the manufacture of wooden shoes of a special type. Anthony Koars is president.

The Stuebing Truck Company, 308-310 Walnut Street, Cincinnati, contemplates further additions to its manufacturing equipment. A list of machines needed has not yet been made up.

The Efficiency Heater Company, Piqua, Ohio, has been incorporated with $150,000 capital stock, by H. D. O'Neall and others. Nothing is yet known as to manufacturing plans.

The Victor Rubber Company, Springfield, Ohio, whose capital stock was increased from $150,000 to $300,000, is having plans prepared for two additions to its plant that are expected to be completed in the early part of next year.

The Lamneck Company, Columbus, Ohio, manufacturer of warming and ventilating apparatus, states that the reports to the effect that it expects to erect an additional factory are incorrect. Later on the company may consolidate its two plants under one roof and increase its manufacturing facilities.

The Recording & Protecting Lock Company, Dayton, Ohio, has increased its capital stock from $50,000 to $125,000, and will install additional equipment.

It is officially announced that the plant of the Wright Aeroplane Company, Dayton, Ohio, will not be removed from that city. Plans are being prepared for doubling its capacity.

The Maxwell Motor Car Company, Dayton, Ohio, is having plans prepared for doubling the capacity of its body-building plant. Woodworking and other equipment will be required.

The Muskingum Iron Works Company has secured a building at Marietta, Ohio, which will be fitted up as a sheet metal shop. The company expects to make small tanks, small boilers, etc. Only a limited quantity of metal-working equipment will be required. F. F. Sherman is president and general manager.

The Central South

LOUISVILLE, KY., Oct. 25, 1915.

Business conditions continue to improve. Power equipment manufacturers report a good trade, and the prospects are likewise good for a busy winter. Demand for electrical apparatus is also good, and the call for machinery from the mines of eastern Kentucky is strong. Wood-working machinery is active, due to the improvement in the lumber and allied trades.

The Roy C. Whayne Supply Company, Lincoln Building, Louisville, is in the market for a power-driven drill, suitable for drilling a 2-in. hole 6 ft. deep in earth.

D. X. Murphy & Brother, Louisville, have specifications for alterations in the engine-room of the Western State Hospital, Hopkinsville, Ky., for which bids will be received until Nov. 5.

The J. J. Reilly Mfg. Company, Louisville, has changed its name to the Freville-Piatt Company and reduced its capital stock from $50,000 to $30,000. The company makes pumps.

McCandless & Bond, 307 East Oak Street, Louisville, have begun the construction of a garage which will be equipped for repair work.

Mayfield, Ky., will vote Nov. 2 on a bond issue for the purchase and improvement of the electric light and water plants.

Wiley W. Gibson & Son, Mater, Ky., are planning the establishment of an electric light plant at Whitesburg, Ky.

The American Metallic Packing Company, Lexington, Ky., is in the market for a 40-hp. hoisting engine, with drum attached, second-hand.

The Auxier Coal & Mining Company, Auxier, Ky., is in the market for a 12-hp. boiler and a 4-in. double-action pump.

The Cloverport Boat & Mfg. Company, Cloverport, Ky., has decided to operate a machine shop and foundry in connection with its boat factory, and is in the market for machine tools and other equipment. J. W. Pate is manager.

H. Y. Davis, Cave City, Ky., has started the construction of a garage to cost $8,000.

The Hull Pump & Tank Company, Owensboro, Ky., has been organized with $100,000 capital stock by W. D. Hull, J. J. Trefz and others, to make automatic self-measuring pumps for handling oil. It will begin the erection and equipment of a factory in the immediate future.

Harvey Gentry and Stephen Haydon, Harrodsburg, Ky., will be in the market shortly for equipment for an automobile repair shop.

The bottling plant of J. F. Morris, Murray, Ky., was burned recently with a loss of $5,000. Power equipment was also destroyed. The plant will be replaced.

The Isaacs & Baker Company, Berea, Ky., has acquired a franchise for an electric light system, and is in the market for the necessary equipment.

The Ross-Republic Marble Company, Knoxville, Tenn., whose mill was recently burned, will rebuild. All of the machinery except a 200-hp. Corliss engine has been purchased.

The G. W. Simmons Company, 89 South Front Street, Memphis, Tenn., is in the market for a round head 30-in. double surfacer. A used Berlin or Whitney machine is desired.

The Camden Electric Light Company, Camden, Tenn., has been organized to rebuild the electric light plant in that town, which was recently burned. Address John D. Rice.

McMinnville, Tenn., has purchased a site for a water-power plant and will install equipment.

The D. T. McKeithlan Lumber Company, Lumber, S. C., is in the market for a second-hand 150-hp. boiler, capable of developing a pressure of 120 lb.

Mathews Brothers, Norfolk, Va., are in the market for equipment for a paint factory with a daily production of 1000 gal. Motor-driven mixers, grinders, etc., will be installed.

I. H. Case, manager of the Municipal Industrial Commission, Newport News, Va., has information regarding the location of a plant to manufacture ammunition.

John Fassol & Co., Hopewell, Va., are in the market for electrical generating equipment.

The Pennington Milling Company, Pennington Gap, Va., will rebuild its plant, which was recently burned. Power and special equipment for a production of 100 bbl. a day will be needed.

The Gas Engine & Boat Corporation, Norfolk, Va., has been organized with $20,000 capital stock by W. H. Thompson, J. H. Curtis and others.

The sawmill, planing-mill and picket factory of the Hodge Fence & Lumber Company, Lake Charles, La., were recently burned with a loss of $60,000. The picket plant will be rebuilt at once.

Birmingham

BIRMINGHAM, ALA., Oct. 25, 1915.

The revival of the lumber interests seems to be complete, with the result that the call for wood-working machinery is keeping the dealers busy. Coal mine equipment is also moving freely. The general condition continues to improve, especially in the immediate Birmingham district.

The Derailment Brake Company, Cullman, Ala., has been incorporated with a capital stock of $2,000 by Wilbur Emethvin and others.

The Terminal Transfer & Storage Company, Mobile, has engaged Moores & Dunford, architects and engineers, Chicago, Ill., as engineers for the construction of a system of warehouses, terminals, tracks, etc., to cost $1,000,000.

The One-Piece Box Company, Jacksonville, Fla., capital stock $50,000, has been incorporated by H. G. Perring, F. H. Schulenberg and others to manufacture cardboard boxes.

St. Louis

ST. LOUIS, MO., Oct. 25, 1915.

The machine-tool market here is hampered by the failure to get delivery. Even other lines than those available for war munition use are being affected to some extent by the turning of manufacturing plants from their accustomed lines of production because of the war profits. In consequence the demand for second-hand tools, of which the market is almost cleared, is very keen. It is considered likely that these machines will come up for replacement by the time the war rush is over, and that this fact will extend the activity of business somewhat farther than would otherwise be the case. The tendency toward the establishment of new industries is growing and capital is more freely available. In general business in this territory may be regarded as fully up to normal and in some lines considerably better than that.

The Jenkins Vulcan Spring Company, St. Louis, Mo., has been incorporated with a capital stock of $40,000 by T. B. Jenkins, R. G. Zetrouer, J. F. Jenkins and others to manufacture motor vehicle springs, etc.

The Hathaway Rotary Valve Motor Company, St. Louis, Mo., has been incorporated with a capital stock of $175,000 by Charles E. Hathaway, Joseph Mayer, Charles H. Reeder and others to manufacture a rotary valve internal combustion engine.

The Monsanto Chemical Works, St. Louis, Mo., will erect a four-story and basement addition, 67 x 112 ft., to its plant.

J. Johansen, St. Louis, Mo., will erect a machine shop and garage, three stories, with automobile elevators, etc.

The McKenzie Mfg. Company, St. Louis, Mo., has been incorporated with a capital stock of $48,000 by Benjamin McKenzie, J. B. Horstmann, W. Dulaney Reese and others to do a general iron and steel manufacturing business.

The Firman L. Carswell Mfg. Company, Kansas City, Mo., has been incorporated with a capital stock of $10,000 for the manufacture of farm machinery, tools, etc. The principal stockholders are Firman L. Carswell, Arthur L. Hobson and A. I. Beach, all of Kansas City, Mo.

Gallatin, Mo., will install new equipment, including two Diesel type oil engines, one 75-kw. generator, two centrifugal pumps, two deep well pumps, with motors and other accessories. E. E. Harper, Grand Avenue Temple, Kansas City, Mo., is the consulting engineer.

The city of Slater, Mo., will install one 250-kw. three-phase sixty-cycle, 2300-volt generator direct connected to a 300-hp. engine. J. A. Stern is city clerk.

The Steelville Electric Light & Power Company, Steelville, Mo., will install an electric light and power generating plant to cost about $10,000.

D. Ingebrigston, representing the Royal Artificial Limb & Brace Company, has acquired a site and will erect a plant for the manufacture of artificial limbs at 3236 East Ninth Street, Kansas City, Mo.

The Border City Iron & Steel Company, Fort Smith, Ark., has been incorporated with a capital stock of $25,000 by James W. Arnold, R. W. Cotton and K. Collins and will remodel the plant of the Fort Smith Steel Company.

Speice Brothers, Jonesboro, Ark., will equip a plant for the manufacture of barrel hoops and are in the market for machinery and a power plant.

The F. Keich Mfg. Company, Nettleton, Ark., will equip a wood-working plant at Lake City, Ark., also a shingle mill.

The Fisher Vehicle Wood Stock & Lumber Company, Erin, Ark., will install equipment for a vehicle woodstock plant at Little Rock, Ark.

The Arkansas Light & Power Company, Newport, Ark., will install two engines and a turbine pump of 1000-gal. per minute capacity at its power plant.

The Terral Petroleum Company, Chandler, Okla., has been incorporated with a capital stock of $100,000 by F. A. Rittenhouse, Chandler, George P. Stein and James M. Cover, Somerset, Pa., and is in the market for drilling and pumping equipment.

The Kim Oil and Gas Company, Oklahoma City, Okla., has been incorporated with a capital stock of $100,000 by Edgar D. Smith, Oklahoma City, and E. W. Kimbley and T. J. Farrar, Okmulgee, Okla., and will install drilling and pumping equipment.

N. H. Welch, Ponca City, Okla., is reported in the market for electric generating equipment.

The Newton Oil Mill Company, Newton, Miss., has been incorporated with a capital stock of $50,000 by G. W. Covington, Hazlehurst, W. D. Lowe, Canton, and J. P. Perry, Grenada, Miss., and will equip a cotton-seed oil mill.

About $15,000 will be expended by R. L. Benson of Chicago, Ill., in re-equipping the Capital Light & Power Company plant at Jackson, Miss., which he recently purchased.

The Hodge Fence & Lumber Company's mill at Lake Charles, La., which has been burned with a loss of $60,000, will be replaced.

Texas

AUSTIN, TEXAS, Oct. 23, 1915.

Orders for machinery and tools for delivery in Mexico have been placed the past week in San Antonio and El Paso. Trade conditions in Texas and the Southwest generally are unusually good.

The Farmers' Gin Company, Greenville, has been organized with a capital stock of $15,000 to build a cotton gin. F. J. Phillips is a stockholder.

The Clayton Gin-Compress Company, Houston, which has been formed with a capital stock of $75,000, will build a cotton gin and compress. M. D. Anderson is in charge.

Brown White, Fort Worth, plans to build a plant at El Paso for the manufacture of refrigerators.

The Forney Water, Light & Ice Company, Forney, has increased its capital stock from $20,000 to $25,000 for the purpose of making improvements to its plant.

Galveston, Tex., will receive bids until 5 p. m., Nov. 4, for mechanical equipment for an air-pumping engine. John B. Kelley is city secretary.

San Francisco

SAN FRANCISCO, CAL., Oct. 19, 1915.

Small inquiries for machine tools are fairly numerous, but no business worth mentioning is being closed, owing to a paucity of stocks. Large buyers are still holding off, though some important projects are expected to come up before the end of the year. A good many tools that have been on exhibition at the exposition will be available in December, but little effort has been made to dispose of them as yet. The market for miscellaneous machinery shows little change. Some few lines are in good demand. The situation in general remains quiet, with comparatively little development work under way. Highway work, however, is picking up, bringing a better demand for contractors' equipment, and the mining interests continue actively in the market. Wood-working machinery receives a little more attention, but the movement is by no means normal. The demand for implements and traction engines keeps up remarkably well. Interest in internal combustion engines using cheap grades of oil is rapidly increasing, and some substantial business is in sight in both large and small engines. Shipbuilding operations are increasing. The Union Iron Works has just received a contract for a large steamer for the Matson Navigation Company, and is reported to have a new contract also for a 14,000-ton tank steamer for the Standard Oil Company of New York.

A number of the foundries in the northern California mining district have lately taken good-sized orders for ore mills and other equipment.

The Hansen Auto & Machine Works, Pasadena, Cal., will purchase the plant and business of W. G. Hansen.

The American Coin Register Company, Oakland, has lately placed orders for a number of tools with local merchants.

The Spanish Peak Lumber Company has let a contract to the United States Steel Products Company for the construction of an aerial tramway, six miles in length, and will build a saw mill near Grays Flat on the Western Pacific Railroad.

The Patterson & Western Railroad Company has been incorporated at Stockton, Cal., with a capital stock of $150,000, by the owners of magnesite mines west of Patterson, Cal., who propose to build a railroad from that place to the mines.

The Hall-Scott Motor Company, Crocker Building, San Francisco, with a shop at Berkeley, is starting the manufacture of aeroplane engines.

The General Equipment Company, dealing in railway and contractors' machinery, has moved its office from the Hearst Building to 1098 Harrison Street, San Francisco. George Hosmer is manager.

The Western States Gas & Electric Company, Eureka, Cal., is preparing to rebuild its boiler plant, and will put in two new boilers of 600 hp. capacity each.

The Pacific Northwest

SEATTLE, WASH., Oct. 19, 1915.

Business in the Northwest has become distinctly better in the past few weeks. The Pacific coast states are now beginning to feel the good result from a return to condition of activity in all the manufacturing centers in the East. From the Mississippi Valley to Puget Sound along the line of the Chicago, Milwaukee & St. Paul Railway, enormous cereal crops are being harvested, or have been exchanged by the farmers for cash. In every line, tonnage moving from Seattle and other Puget Sound cities to the East is increasing, and factory and general trade activities are measurably improved.

The Smith Cannery Machines Company, Seattle, has shipped to Eastern plants making war munitions several thousand dollars worth of engine lathes. Further orders are booked from factories which were caught by the rush of war orders short of many necessary tools. The local company some time ago began the manufacture of engine lathes of designs perfected in its plant, but the Pacific coast demand did not absorb them. The lathes weigh about 4000 lb. each.

The Helena Machinery & Junk Company has opened for business in Helena, Mont. The company's warehouses, grounds and sheds cover several acres of land near the railroad tracks.

The Dearlove-Izard Mfg. Company, Portland, Ore., has filed articles of incorporation, with capital stock of $10,000. It plans the construction of a plant for the manufacture of oil burners. George Dearlove, Henry Izard and Royal Boatman are the incorporators.

The sawmill plant and box factory owned by George H. Gray & Co., Entiat, Wash., was destroyed by fire recently, with a loss of $60,000.

A cement plant costing about $100,000 will be built in Cordova, Alaska, immediately by F. T. Frank of that city to manufacture cement from clinker.

The Portland Woolen Mills, Portland, Ore., will install new boilers. Plans are being prepared by Lewis Thompson.

The Lamm Lumber Company, Klamath Falls, Ore., will erect a mill on Upper Klamath Lake, near Modoc Point. It will have capacity of 60,000 to 70,000 ft. per day. W. E. Lamm is president.

The West Coast Iron Works, Seattle, Wash., plans to increase the scope of its plant, which was recently equipped with an electric furnace, 42-in. open-side planer, and other machinery. A. K. Isham is president and manager.

The Rothert Process Steel Company, Leavenworth, Wash., has filed articles of incorporation for $1,000,000, with E. H. Rothert, J. B. McNutt, N. A. Pearson, P. A. Snyder, all of Leavenworth, and E. F. Foss, Spokane, as incorporators. It proposes to erect a plant for the manufacture of iron and steel near Leavenworth, where a site has been secured.

Charles Colton, Eugene, Ore., and associates have purchased the Thirteenth Avenue planing mill and will immediately convert it into a handle factory. New machinery will be purchased.

The Lake Mercantile Company, Great Falls, Mont., will build an addition to its machine shop, 50 x 60 ft.

The Coast Culvert & Flume Company, Kenton, Ore., is making extensive improvements, increasing the capacity of its plant and installing more equipment.

The Green Machinery & Mfg. Company, Salt Lake City, Utah, recently incorporated, has purchased the business of the Green Concrete Mixer Company, Dayton, Ohio, and Salt Lake, and will manufacture the concrete mixers in addition to manufacturing and selling machinery of various kinds.

Canada

TORONTO, Oct. 25, 1915.

The Standard Steel Company, Ltd., Montreal, has been incorporated with a capital stock of $200,000 by Louis A. David, Louis E. A. D. Mailhiot, S. H. R. Bush and others to manufacture corrugated steel pipe, metal, agricultural implements, shells, cartridges, etc.

The Premier Sales Company of Canada, Ltd., Montreal, has been incorporated with a capital stock of $100,000 by Leslie H. Boyd, Alexander R. Johnson, Arthur Ross and others to manufacture machinery, war munitions, adding machines, etc.

The Canadian Chadwick Metal Company, Ltd., Dundas, Ont., has been incorporated with a capital stock of $40,000 by Arthur B. Turner, Henry R. Burbidge, John R. Marshall and others of Hamilton, Ont., to manufacture brass, iron, etc.

The Canadian Malleable Iron Company, Ltd., Third Avenue, Owen Sound, Ont., will equip its plant for the manufacture of 60-lb. high explosive shells.

R. H. Bellamy, Box 134, Mount Brydges, Ont., will purchase material for the factory to be erected there for the Crow Automobile Company.

W. P. Gonder, Culp Street, Niagara Falls, Ont., is in the market for turning machinery to cost $1,000.

The Owen Sound Iron Works Company, 1175 First Avenue, East, Owen Sound, Ont., will shortly install machinery in its plant to manufacture high explosive shells.

The Victoria Chemical Company, Victoria, B. C., will commence shortly on the erection of an addition to its plant for the manufacture of war material.

David Maxwell & Sons, St. Mary's, Ont., have received a contract to manufacture 100,000 plugs for shells.

J. E. Gardner, Morrison Street, Niagara Falls, Ont., is in the market for a 20-hp. engine and boiler to operate a sawmill.

The Canadian Tube & Iron Company, Montreal, is building a machine shop on St. Patrick Street.

The George H. Beton Lumber Company, Rectory Street, London, Ont., is planning to add electrical equipment to operate woodworking machinery.

The Canadian Bridge Company, Ltd., Walkerville, Ont., has been incorporated with a capital stock of $2,000,000 by A. L. Colby, Charles T. Miller and others of Walkerville, Ont., to manufacture steel girders, iron, steel and to build bridges, etc.

The ratepayers of Port Moody, B. C., passed a by-law to guarantee the debentures of the Port Moody Steel Works, Ltd., recently incorporated. In return the company will build a steel plant and rolling mills to cost $100,000.

A site has been purchased at Washademoak, N. B., by Daley & Carvell, St. John, N. B., on which they will build an axe-handle and woodworking plant.

NEW TRADE PUBLICATIONS

Metal Cutting Saws.—Simonds Mfg. Company, Fitchburg, Mass. Pamphlet. Lists a line of metal cutting saws for various machines. Illustrations of the several kinds of teeth that can be supplied are presented, together with tables giving the various sizes of saws. The different methods of cutting steel are described at some length and mention is made of a line of hack saw frames and blades and files.

Steam Hammers.—Buffalo Foundry & Machine Co., Buffalo, N. Y. Bulletins Nos. 1007, 1008, 1009, 1010 and 1509. Illustrate the standard guide single frame, combined, open frame, double frame and double frame steam drop type of hammers. To make-up of the bulletins is identical, illustrations with condensed specification tables being presented on one of the inside pages with a description of the particular hammer covered on the facing one.

Drill Steel.—Kidd Drawn Steel Company, Aliquippa, Pa. Pamphlet. Pertains to a line of drill rod steel that is made in a number of different sizes and shapes. Suggestions as to the uses to which the various brands can be put are given and this is followed by a list of the sizes that can be supplied. A table giving the approximate weight, etc., of the several sizes is included and reproductions of some of the shapes complete the pamphlet.

Pulverizer Mill.—Lehigh Car, Wheel & Axle Works, Catasauqua, Pa. Catalog No. 70. Pertains to the Fuller-Lehigh pulverizer mill for various substances. After a partial list of the materials handled, some of the characteristics of the mill are given. This is followed by a description of the sweep discharger type of mill with a list of abstract specifications, illustrations of the various sizes and diagrams and lists of parts. The same practice is followed for the fan discharge type and a number of diagrams of motor and lineshaft driven machines and buildings in which the mills are installed are included. A number of views of installations of these mills are presented with brief statements of the character of the work being done.

Bolt Heading Machine.—National Machinery Company, Tiffin, Ohio. Circular. Calls attention to a continuous-motion semi-automatic bolt heading machine of the hammer type in which the number of blows in the making of a bolt is fixed by a cam and gear arrangement according to the finish required and remains the same throughout the run. An illustration and brief description of the machine are presented, and particular attention is called to some of the features of the machine, such as freedom from manual labor and fatigue on the part of the operator, uniform finish of a run of bolt and increased output.

Crane Limit Stop and Switchboards.—Electric Controller & Mfg. Company, Cleveland, Ohio. Two bulletins and spare part catalog No. 115. The first bulletin, No. 1040, superseding bulletin No. 1036, refers to a safety limit stop designed to prevent overtravel of the hook blocks of electric cranes. The advantages of the stop are briefly touched upon, emphasis being laid upon the fact that it is not necessary to reset the stop after operation. A dimension diagram and a drawing showing the way in which the stop is mounted on a crane are included. The second bulletin, No. 1041, superseding Nos. 1005 and 1028, gives general description and specifications for a crane switchboard for direct-current motors designed to take the place of the various circuit breakers, knife switches, fuses, etc., usually mounted in the cage. The spare part catalog lists the various parts for a magnetic switch.

Dial Gages.—B. C. Ames Company, Waltham, Mass. Booklet. Gives illustrations and descriptions of a line of dial gages for use in measuring a great variety of parts. The different types of gage heads are illustrated with brief descriptions of the sizes in which they can be supplied and the work for which they are designed. Among the gages covered is a tool makers' testing outfit which was illustrated in THE IRON AGE, May 20, 1915.

Motor Trucks.—Stewart Iron Works Company, Cincinnati, Ohio. Catalog. Devoted to a 1-ton truck that is made with five different types of bodies to suit all demands. A comparative diagram showing the load distribution and economy of traffic and garage space occupied by the Stewart truck in comparison with others of similar body capacity is presented. Specifications of the trucks and views of the various types of bodies are included.

Steam Hammers and Traveling Grate.—Erie Foundry Company, Erie, Pa. Collection of pamphlets. Mention a line of steam hammers of the single and double frame, tool dressing and drop types and a traveling grate. In all of the hammer pamphlets illustrations, brief statements of the work the hammers are designed to do and tables of specifications are presented, together with a somewhat complete description of the various parts. In the traveling grate pamphlet the adaptability of the grate to burn all classes of fuel and respond to peak loads quickly is touched upon, followed by a descriptio nof the mechanical construction in which special emphasis is laid on the ability to change the rate of travel without interrupting the operation.

Motor Trucks.—United States Motor Truck Company, Cincinnati, Ohio. Pamphlet. Illustrates and describes a line of heavy service trucks which are built in four sizes with normal load capacities of 2, 2½, 3 and 4 tons. Specifications for the various trucks are presented and a number of views are given of the motors used and the trucks themselves in service.

Internal Combustion Engine Appliances.—William Powell Company, Cincinnati, Ohio. Pamphlet. Describes a line of appliances for motor trucks, automobiles and motor boats propelled by gas, gasoline or oil engines. These include valves; priming, oil and grease cups; lubricators of various types and pipe fittings. All of the various appliances are illustrated with brief descriptions and tables of the sizes in which they can be supplied. Considerable useful information on the subject of lubrication is included.

Centrifugal Pumps.—De Laval Steam Turbine Company, Trenton, N. J. Pamphlet entitled "The Cost of Pumping Water." Contains a number of graphical charts with accompanying explanatory text, and has for its object the facilitating of the computation of the over-all economy of different types of pumping units, where the cost of fuel, steam pressure, rate of interest, cost of apparatus and other variables are known. The first chart shows the number of B.t.u. represented by each pound of steam for various combinations of superheat, steam pressure and feed water temperature, while the second gives the cost of 1000 lb. of steam and the cost of 1,000,000 B.t.u. in the steam from the cost of coal per ton, the heat value of the coal and the boiler efficiency. The third diagram shows the relation existing between the average cost of steam-turbine-driven centrifugal pumping units and the head pumped against and the fourth the amount of money to be set aside yearly for sinking fund, to cover depreciation for different terms of life and rates of interest. The fifth diagram is the Mollier steam chart supplemented by a scale for determining the B.t.u. available per pound between given limits. The sixth diagram is an alignment chart for determining the resistance of pipes to the flow of water. A list of representative installations of centrifugal pumps completes the pamphlet.

Pneumatic Tools.—Independent Pneumatic Tool Company, Thor Building, Chicago, Ill. Circular W. Presents illustrations of various types of pneumatic tools, such as air drills, hammers, etc. Views of the different styles of drills and hammers are presented and the special features of the tools, which include Corliss valves, roller bearings, telescopic screw feeds, removable crank chamber plate and a two-part cast-steel casing, are mentioned. A list of the tools making up the Thor line is included together with a condensed table of specifications for the drills and hammers.

Babbitt Metal.—Theodore Hiertz Metal Company, Tenth and Poepping streets, St. Louis, Mo. Folder. Covers a line of babbitt and anti-friction metals that are made in a number of different grades. Reproductions of the ingots in which these metals are cast are given with a condensed statement of the work for which they are designed. Mention is also made of a line of solders.

Turbine Pumps.—Kingsford Foundry & Machine Works, Oswego, N. Y. Catalog No. 18. Relates to a turbine pump for use in water works and industrial plants, for fire protection and boiler feed service and in mines. The details of construction of the pump are gone into at some length, and reference is made to its particular adaptability for the various classes of service for which it is designed. A number of views of the pump are presented, together with a sectional view and a reproduction of a characteristic curve.

Metal Working and Rolling Mill Machinery.—A. Garrison Foundry Company, Pittsburgh, Pa. Pamphlet. Collection of illustrations of rolling mill and metal working machinery, such as chilled and sand rolls, hot and cold rolling mills and auxiliaries, shearing machines of various sizes and styles, presses, drop hammers, etc. There is no text at all in the pamphlet, a separate leaf being given to each machine. This contains an illustration of the machine with a brief caption and a reference to the illustration number by which it is identified.

Plating Barrel.—U. S. Electro Galvanizing Company, 1 Park Avenue, Brooklyn, N. Y. Pamphlet. Illustrations and descriptive matter explain the operation of an automatic self-emptying plating barrel. The advantages claimed for the barrel are simplicity and convenience of operation, absence of gears and wood. The construction and operation of the barrel are gone into at some length with directions for its installation.